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FREITAG (J. H.) & SEVERIN (H. H. P.). **Poison-hemlock-ringspot virus and its transmission by aphids to Celery.**—*Hilgardia*, xvi, 8, pp. 389–410, 4 pl., 1945.

A common umbelliferous weed, poison hemlock (*Conium maculatum*), was found naturally infected with a ring-spot virus in the course of a search for a weed reservoir of the western celery mosaic virus [celery mosaic virus: *R.A.M.*, xviii, p. 369]. The most characteristic features of this disease are chlorotic lines, often surrounding green areas of the leaf surface, and developing from primary symptoms associated with the appearance on the intermediate leaves of artificially infected plants of small, pale green areas, which are usually irregular in shape and scattered and tend to become larger and may show chlorosis, usually observed more along the margin or apical region than near the leaf base. No stunting is seen under field conditions, but the leaves along the midrib are often curled downward and exhibit characteristic mottling with ring-spot markings.

The following were successfully infected by means of the honeysuckle aphid (*Rhopalosiphum conii*): celery, celeriac, dill (*Anethum graveolens*), salad chervil (*Anthriscus cerefolium*), coriander (*Coriandrum sativum*), carrot varieties, parsnips, and varieties of parsley. The virus was recovered from these plants and transferred to healthy celery.

In the course of experiments the ring-spot virus was shown to be systemic in celery; parsley was artificially infected with it from parsley in 14·1 per cent. of the tests undertaken, but attempts at transmission from poison hemlock and celery failed. Further experiments showed that 11 species of aphids breeding on celery are carriers of the virus; that four out of five aphids which do not breed on celery or poison hemlock were unable to transmit it; while the fifth, *R. pseudobrassicae*, infected one out of 25 plants; and that the honeysuckle aphid, during feeding periods of 10 to 15 minutes, proved a vector in a few of many tests. Honeysuckle aphids, hitherto not known to transmit the virus, when fed hourly on nine healthy celery plants, commonly transmitted it to the first plant fed on, but infected later plants only to a small extent. Four aphid species were found to lose the virus during the first 24 hours on healthy plants, five showed a low percentage of infection during a second 24 hours, and none transmitted it after 48. These same aphids proved capable of recovering the virus from plants three days after inoculation and, as the incubation period was seven days, thus showed that they could acquire the virus before the symptoms appear. Aphids acquired the virus as easily during 181 to 200 days after infection as during the first 20 days.

NUSBAUM (C. J.). **Internal cork, a new disease of Sweet Potato of unidentified cause.**—*Phytopathology*, xxxvi, 1, pp. 18–23, 2 figs., 1946.

In the spring of 1944, Porto Rico sweet potatoes were found to be widely affected in South Carolina by an internal corky spotting, which usually became apparent only on sectioning the roots, though an occasional cavity developed on the surface above an immediately underlying lesion. The dark brown to black,

hard spots may attain a diameter of about 3 cm. and rarely exceed 5 cm. in length. The examination of fixed and stained material of the larger lesions revealed an irregular central area of collapsed cells, surrounded by a phellem layer in which the presence of suberin in the cell walls was detected by the reddening of the tissues treated with Sudan IV. The remains of disorganized xylem vessels were sometimes found in the necrotic zone. The ventral surfaces of the older leaves of plants with corky roots sometimes bore conspicuous purplish, circular spots with greenish centres, probably, but not certainly, correlated with the internal symptoms. Culturable pathogens and boron deficiency having been excluded as causes of the disease, the implication of a virus in its etiology is suspected.

BLACK (L. M.), PRICE (W. C.), & WYCKOFF (R. W. G.). **The electron micrography of plant virus-antibody mixtures.**—*Proc. Soc. exp. Biol., N.Y.*, lxi, 1, pp. 9–10, 4 figs., 1946.

Shadowed electron micrographs of mixtures of purified southern bean mosaic and tomato bushy stunt [*R.A.M.*, xxv, p. 25] viruses with their specific antisera reveal their spherical elementary bodies aggregated into microflocs, in which the particle separations appear to be about twice their normal values. A more detailed study of the systems is in progress.

BAWDEN (F. C.). **Virus diseases of plants.**—*J. R. Soc. Arts*, xciv, 4710, pp. 136–168, 21 figs., 1946.

In this paper, based on three lectures delivered before the Royal Society of Arts, London, in November and December, 1945, the writer, after an introductory discussion of the meaning of the term 'virus', deals with the external symptoms of virus diseases in plants, virus strains and mutation, internal symptoms, methods of transmission, factors affecting spread in the field, seed transmission, purification, chemical and physical properties, sizes of virus particles, and multiplication.

WILLIAMS (P. H.), SHEARD (ENID), SELMAN (I. W.), & OWEN (O.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1944*, pp. 21–31, 1945.

In the opening section of this report [*R.A.M.*, xxiv, p. 89], P. H. WILLIAMS records that in 23 per cent. of the total number of specimens received (of which 549 or 86 per cent. were tomatoes) *Phytophthora* spp. proved to be the causal agents of the diseases present.

Reports that the pathogenicity of *Verticillium* wilt of eggplants was reduced by altering the acidity of the soil by sulphur or lime amendments suggested experiments to determine the effect of acidity of the medium on strain 57, a culture of *V. albo-atrum*, and strain 49, a single-spore culture of *V. dahliae*. The results, which are tabulated, show good growth of the fungi between P_H 4 and 8, but growth was arrested or inhibited below P_H 4. It does not seem possible therefore to acidify the soil sufficiently to induce an unsuitable habitat for *Verticillium*.

In 1942, with a view to testing the possible seed transmission of *Verticillium* wilt, Ailsa Craig tomato plants, set in 10-in. pots on 23rd April were infected under the ball of the roots with cultures of *V. albo-atrum* or *V. dahliae*. By 22nd May severe wilt symptoms had developed in those inoculated with *V. albo-atrum*, but they recovered. The plants inoculated with *V. dahliae* showed no infection until the characteristic yellowing of the lower leaves became evident on 1st June. Regular growth, however, continued, accompanied by no signs of malformation. Further experiments in 1944 gave similar results. In experiments to detect the transmission of *Verticillium* wilt by tomato seeds from infected plants no fungal growth was obtained either from seed surfaces or from the tissues of young seedlings. Nevertheless, seed-saving from healthy plants only is recommended.

For 11 counties 19 records of infection by *V. albo-atrum* and 9 by *V. dahliae* were reported during 1943, all records of the second coming from southern England.

E. SHEARD reports outbreaks of stem rot of tomato (*Didymella lycopersici*) in 112 nurseries in 24 counties, infection taking place between mid-March and the end of April and being restricted apparently to the base of the stems, seldom below soil-level; later infections occurred at higher levels. It recurred even where the soil had been steamed or treated with formaldehyde or proprietary sterilizers.

In temperature experiments, pure cultures of *D. lycopersici* were held at 15° C. for three days and then incubated at 35°, several plates being returned daily to 15°. Growth, which ceased at 35°, was resumed at 15°, but only half the cultures resumed growth after five days at 35° and the thermal death point was reached after six. This result is valid only for the vegetative growth of the fungus in pure culture.

Viability tests with pycnospores showed that germination could be obtained in tomato juice 15 to 17 days after drying. From pycnidia on pieces of stem tissue, removed from diseased tomato plants and kept dry in glass tubes at room temperature, prolific sporulation took place immediately the pycnidia were placed in water and spores were still viable after eleven months. Thus, infected plant debris, neglected when cleaning out houses and in sterilizing soil, presents a potential source of infection for the following season's crop. The same danger arises from infected refuse from field-grown tomato plants and haulms left in rubbish heaps.

E. SHEARD describes an infection of heliotrope [*Heliotropium peruvianum*] by *Corticium solani* and considers that this may be the first record of the pathogen on this host. Serious loss of heliotrope cuttings grown in steam-sterilized soil was attributed to their being reared in old, unsterilized boxes. No recurrence was reported when new boxes were used.

I. W. SELMAN's report on the susceptibility of lettuce to mosaic virus infection in relation to soil conditions has already been noted from another source [ibid., xxiv, p. 351]. An investigation into the relation between watering frequency and the effect of mosaic on tomato plants showed that, with the possible exception of the Potentate variety at the medium water-level, there is little sign of any interaction between infection and watering frequency as affecting fruit yield.

Selman discusses the difficulty of safeguarding tomato crops from spotted wilt virus while growers of arum lilies, dahlias, and chrysanthemums are reluctant to destroy these plants when infected with the virus as long as they are able to produce normal blooms. Growers are recommended to select undiseased stocks for propagation and to fumigate regularly old, and possibly diseased stocks, with nicotine shreds (2 oz. per 1,000 cu. ft.) to kill the thrips insect vector.

O. OWEN describes three types of magnesium deficiency in tomatoes. That due to the physiological strain on plants when 4 to 5 ft. high and carrying a heavy crop is manifested by downward curling of the leaf and the development of yellow interveinal areas, while the veins remain dark green and sometimes the margins remain green; a rare effect is a thinning and grey-green discoloration of the tip, continuance of which may cause setting failure in the trusses then forming. A high soil potash content tends to induce magnesium deficiency and a timely application of a rich dressing of nitrogen is advocated to remedy this condition. Deficiency due to unsuitable physical conditions in the subsoil can be remedied by improved drainage of the subsoil. This type usually depresses yield and often promotes senescence and early death in batches of plants in a house or block of houses. Magnesium deficiency in tomatoes grown on sandy soils is often attributed to high potash dressings, thereby reducing the magnesium status, but the author considers that nitrogen deficiency or some other subsoil factor is a more likely cause. Growers are recommended to dissolve 20 lb. Epsom salts [magnesium sulphate] in 100 gals. water with a wetter and to spray the leaves with a 2 per cent.

solution. Sulphonated lorol at 8 oz. or agral at 6 fluid oz. per 100 gals. proved effective wetters. In serious cases spraying should begin from 8 to 10 weeks after planting, with repetitions every fortnight.

New plant diseases.—*Agric. Gaz. N.S.W.*, lvii, 1, pp. 25–26, 1946.

Included in this list of 36 plant diseases in New South Wales newly recorded during the nineteen months ended 30th November, 1945, are the following: root rot of *Chrysanthemum* (*Macrophomina phaseoli*), leaf spots of parsnip (*Ramularia pastinacae* and *Cercosporella pastinacae*), neck [dry] rot of *Gladiolus*, mango powdery mildew (*Oidium* sp.), and collar rot of French marigold (*Tagetes* sp.) due to *Phytophthora cryptogea*.

Fields (W. S.). **Summary of the more important plant diseases taken in connection with the insect and plant disease survey in the general vicinity of the ports of entry from January 1945 to June 30, 1945.**—*Plant Dis. Reptr*, xxix, 11, pp. 693–697, 1945. [Mimeographed.]

This list of 93 fungi and viruses observed in the vicinity of the United States ports of entry during the period January to 30th June, 1945, includes the following species believed not to have been reported previously in that country: *Ascochyta caricae* Rab., causing large leaf spots on figs [*R.A.M.*, ix, p. 227] in Oregon; *Heterosporium betae* on *Beta vulgaris macrorhiza*; *Taphrina bullata* [ibid., iii, p. 724; viii, p. 111] on pear in Washington in 1944; and pea enation virus on *Melilotus* in California [ibid., xiv, p. 486] in 1943. In addition *A. nicotianae* on tobacco in Washington is suspected of being a new record [cf. ibid., v, p. 599]; *Botryosphaeria ribis* on *Taxus baccata fastigiata* in Philadelphia, a new host record; *Oidium mangiferae* on mango in California in 1944, believed to be first report for California and the western United States.

Riker (A. J.), Spoerl (E.), & Gutsche (Alice E.). **Some comparisons of bacterial plant galls and of their causal agents.**—*Bot. Rev.*, xii, 2, pp. 57–82, 1946.

Most of the more recent literature reviewed in this comparative survey of bacterial plant galls and their agents has already been noticed from the original sources. The present paper includes synoptic tables showing (1) the causal organisms and prominent hosts of nine diseases of this type, namely, beet pocket rot (*Phytomonas* [*Bacterium*] *beticola*) [*R.A.M.*, viii, p. 148], cane gall (*P.* [*Pseudomonas*] *rubi*) [ibid., xx, p. 374], crown gall (*Phytomonas* [*Bact.*] *tumefaciens*) on a very wide host range, especially among the Rosaceae, Douglas fir (*Pseudotsuga taxifolia*) gall (*Phytomonas* [*Bact.*] *pseudotsugae*) [ibid., xvi, p. 719], *Gypsophila* gall (*P.* [*Bact.*] *gypsophilae*) [ibid., xiii, p. 772], hairy root (*P.* [*Bact.*] *rhizogenes*) on apple and rose [ibid., x, p. 166], oleander knot (*P. tonelliana*) [*Pseudomonas savastanoi* var. *nerii*: ibid., vii, p. 725], olive knot (*Phytomonas* [*Pseudomonas*] *savastanoi*) [ibid., ii, p. 12], and pea fasciation (*Phytomonas* [*Corynebacterium*] *fascians*) [ibid., xvi, p. 102; xxi, p. 365]; (2) the differential characters of the nine bacteria inducing cell proliferation; and (3) some critical points in the life-histories of the same organisms in relation to their pathogenesis. The bibliography comprises 59 titles.

Starr (M. P.). **The nutrition of phytopathogenic bacteria. I. Minimal nutritive requirements of the genus Xanthomonas.**—*J. Bact.*, li, 2, pp. 131–143, 3 graphs, 1946.

The minimal nutritive requirements of 113 isolates of phytopathogenic bacteria representing 30 species and varieties of *Xanthomonas* [cf. *R.A.M.*, xxii, p. 344] were determined under conditions of controlled inoculum, carefully cleaned glass-

ware, and pure medium components. Most of the species were found to be capable of a certain amount of growth on the simplest substratum used, viz., sodium chloride, glucose, and salts, among those thriving best on this diet being *X. barbareae*, *X. begoniae*, *X. campestris* var. *armoraciae*, *X. carotae*, *X. corylina*, *X. cucurbitae*, *X. geranii*, *X. incanae*, *X. juglandis*, *X. lespedezae*, *X. maculafoliagardeniae*, *X. malvacearum*, *X. manihotis*, *X. papavericola*, *X. vasculorum*, and *X. vesicatoria* var. *raphanae*. Of the more exacting species, *X. hederae*, *X. translucens* f. sp. *cerealis*, f. sp. *hordei*, f. sp. *hordei-avenae*, and f. sp. *undulosa* responded favourably to the stimulus of *dl*-glutamic acid (0·1 per cent.) and *dl*-methionine (0·02 per cent.) in combination or the latter alone. The growth of *X. phaseoli* var. *fuscans* was promoted by both supplements together and to a moderate extent by glutamic acid alone. *X. pruni* failed to develop in any of the media tested except casein hydrolysate with the addition of nicotinic acid.

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. XIII. Mitteilung. Über die Bedeutung des Colchicins als polyploidisierendes Mittel für den Erreger und als angebliches Bekämpfungsmittel gegen den Wurzelkropf.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note XIII. On the significance of colchicin as a means of inducing polyploidization in the agent and as a reputed method of crown gall control.]—*Zbl. Bakt.*, Abt. 2, cvi, 16–19, pp. 338–350, 5 figs., 1944. [Received May, 1946.]

Negative results were given by experiments on the polyploidization of the *Dahlia* and *Chrysanthemum frutescens* strains of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xxiii, p. 335] by the admixture with the iron-manganese-carrot extract medium of 0·1 to 0·2 per cent. colchicin [ibid., xviii, p. 445]. Attempts at the cure of crown gall in naturally infected apple and pear seedlings and inoculated *Datura tatula* and *Pelargonium zonale* by the application of a 2 per cent. colchicin solution were similarly unsuccessful.

BUVAT (R.). **Recherches sur la dédifférenciation des cellules végétales. II. Cultures de tissus et tumeurs.** [Researches on the dedifferentiation of plant cells. II. Cultures of tissues and tumours.]—*Ann. Sci. nat., Bot.*, Sér. xi, vi, pp. 1–119, 19 pl. (7 col.), 39 figs., 1945.

In the section of this exhaustive study on the dedifferentiation of plant cells that deals with cortical tumours produced by artificial inoculations of pieces of tomato stem with a culture of *Phytomonas* [*Bacterium*] *tumefaciens*, the author concludes that the proliferations produced by this organism are not comparable with animal cancers [cf. *R.A.M.*, xxii, p. 13], on the grounds that the young proliferating cells in the tumour are all diploid, tetraploid cells being found only in a few large cells in old tumours, and that the growth gradually slows down in time.

POSNETTE (A. F.). **Cacao virus research in West Africa.**—*Rep. Cocoa Res. Conf., 1945*, pp. 114–117, 1945.

In the Eastern Province of the Gold Coast, cacao swollen shoot [*R.A.M.*, xxv, p. 253] is extending its area of heavy infection, especially to the west of Suhum, where more and more farms are being completely destroyed by the disease. Observations on one farm near Mangoase showed that from 1939 to 1944, swollen shoot killed 74 per cent. of 30–40-year-old and 43 per cent. of the 20–30-year-old trees. The total production fell from 30 tons per annum in 1926–29 to 20 tons in 1936–39, and to only six tons in the last two seasons.

The extension is recorded of cacao viruses into Nigeria, where several outbreaks have occurred in the Ibadan district. The leaf symptoms in Nigeria often resembled

those noticed in Venezuela more closely than those of the Gold Coast. This, with the presence of cacao viruses in Trinidad [ibid., xxiii, p. 379], suggests that cacao virus diseases may occur wherever the crop has been widely cultivated for 30 years or more.

Estimations of the rate at which swollen shoot spreads were based on figures from five different localities and showed that outbreaks increased threefold in three years, 11 times in five years, and 88 times in seven years.

The effectiveness of roguing as a means of control was established under two different sets of conditions. At Tafo, monthly inspections, followed by the prompt removal of affected trees, have checked tree-to-tree spread and also kept fairly constant both the number of new outbreaks and the number of diseased trees during the past three years. In the years 1939 to 1944 there were, respectively, 10, 17, 14, 40, 47, and 41 outbreaks and the numbers of infected trees destroyed were 55, 347, 189, 104, 150, and 185. The large-scale extension of roguing to native farms has also been generally effective; for example, near Nkawkaw, an area of 70 acres was treated in 1942, and showed only 15 diseased trees in November, 1944.

Devastated farms have been replanted on a large scale with at least temporary success, and if farmers can be persuaded to remove the infected trees beforehand the results will be more lasting. When the trees reach bearing age, swollen shoot spreads more rapidly; hence, if control is not practised, the productive life of the new farms will probably be brief. If roguing were regularly practised it is possible that production would soon become profitable again in the areas at present devastated.

Swollen shoot can be caused by any one of a complex of viruses. Cross-immunity tests indicated that strains A (New Juaben) and B (Bisa) may be related, while C (Kpeve) may be outside the swollen shoot complex. It would seem that the viruses may fall into two groups, distinguished by their symptoms and probably by their vectors. H. E. Box [ibid., xxiv, p. 307] has transmitted strains A and B, characterized by prominent swellings, by means of the *Pseudococcus exitiabilis* group. He failed to transmit A and B with *P. citri*, with which, however, he transmitted C and D (Nkawkaw), characterized by very small swellings or the absence of swellings, and a red mottle on the young leaves.

Other work on these viruses showed that strain A gives a positive and C a negative staining reaction in the acidified methyl alcohol test. In graft transmissions, A and C moved from scion to stock at approximately the same speed. Neither A nor B was inactivated in budwood after 40 minutes' immersion in water at 50° C. Strains A, B, and C gave no evidence of seed transmission. Chlorosis and stunting of seedlings from trees affected with A appears to be a physiological effect, these seedlings failing to transmit the virus when grafted to healthy seedlings. No transmission of A occurred when healthy trees were pollinated by infected trees.

It was found that at least a year's infection with the mild strain B is required to produce any immunity from A, and that even then the result is unpredictable for any particular tree.

In the search for resistant cacao plants, no plant has been found to be immune, or resistant to primary infection by grafting. Several were either tolerant of the virulent strain A or immunized against it by the presence of a presumed attenuated strain. A mild virus resembling A in leaf symptoms is now frequently observed in young cacao planted where the original trees were killed. Whatever the explanation may be, clones now exist which are almost symptomless except immediately after propagation by budding, when the first flush of scion growth shows typical mosaic; later growth presents no symptoms. Such plants are not, as a rule, affected by reinfection with A.

ALIBERT (H.). **Note préliminaire sur une nouvelle maladie du Cacaoyer, le 'swollen shoot'.** [Preliminary note on a new Cacao disease, 'swollen shoot'.]—*Agron. trop.* (formerly *Agron. colon.*), i, 1–2, pp. 34–43, 4 figs., 1 map, 1946.

In connexion with the discovery of cacao swollen shoot in Abengourou, Grand-Bassam, Agboville, and Daloa regions of the Ivory Coast [see next abstract], where a survey for the disease was instituted in December, 1943, the writer summarizes the available information, chiefly based on investigations in the Gold Coast [see preceding abstract], on its history, symptomatology, life-cycle of the virus, modes of transmission (grafting and insect vectors), propagation of the disease, damage (in the Gold Coast), distribution in the Ivory Coast (shown by the aid of a useful map), control by (*a*) eradication and burning of diseased trees and (*b*) isolation of resistant varieties, and a staining test, devised at the Institut Pasteur, Paris, for the early diagnosis of infection (before the development of external symptoms). In the Ivory Coast the disease assumes various degrees of severity, including the virulent New Juaben form. With a view to the selection of resistant individuals, small plantations of young trees are to be laid down for observation in the Man district at an altitude ranging from 200 to 1,000 m.

MANGENOT (G.), ALIBERT (H.), & BASSET (A.). **Sur les lésions caractéristiques du swollen shoot en Côte d'Ivoire.** [On the characteristic swollen shoot lesions in the Ivory Coast.]—*C.R. Acad. Sci., Paris*, ccxxii, 13, pp. 749–751, 1946.

Cacao swollen shoot in the eastern regions of the Ivory Coast [see preceding abstract] is characterized in a general way by swellings on the shoots, the preferred sites of which are the young lignified branches, especially the suckers. The leaves of diseased trees tend to be stunted, and some of them bear mottled lesions varying in type in different localities.

In the plantations of Sankadiokro and Apompromou, the creamy-white spots, contrasting vividly with the basic green of the leaf, are very variably distributed, consisting either of plaques of differing size, sometimes confluent, scattered between the secondary veins, or more often of irregular bands distributed at random among the primary and secondary veins, from which they are frequently divided by a strip of green. The network of veins in the area covered by the lesions often presents malformations, apparently caused by contraction during growth, and leads to leaf curvature.

In the Kongodia region the lesions are definitely yellow and generally more diffused than those of the foregoing type, developing between the veins in the form of a sprinkling of numerous small spots, often merging to cover the entire area traversed by several secondary veins, the zones in immediate contact with which, as in the Sankadiokro plantations, tend to remain green. A brownish cast, especially noticeable on the under side, extends over both the green and the yellow areas. The malformations are much less prominent than in the preceding case.

The white lesions, examined microscopically *in vivo*, present translucent plaques, while the air-spaces between the mesophyll cells, so conspicuous in normal leaves, appear to be entirely absent. The chloroplasts are well-differentiated, very minute, ovoid, and semi-colourless, elaborating no starch; in an abnormally siderophile cytoplasm the nucleus may present indications of pycnosis (Feulgen's method). The tannoids are much more abundant than in the normal areas of the leaf, the fibrous sheaths of the more or less atrophied cribrovascular bundles being full of them.

On the other hand, the yellow lesions are never translucent *in vivo*, and the intercellular spaces are occupied, as in normal foliage, by air. The lacunar tissue, however, is more dense than in the healthy parts of the leaf, the lacunae being reduced to narrow slits between the cells or even occasionally absent. The cells are occupied by chloroplasts with an abnormally thin cortex enclosing a grain of

starch; the cytoplasm and nucleus present no exceptional feature. There is, however, hypersecretion of tannins, which in the lower epidermis are often brown.

WHITTAKER (A.). **The Cocoa and Chocolate (War Time) Association.**—*Rep. Cocoa Res. Conf., 1945*, pp. 152–153, 1 map, 1945.

This paper is accompanied by a folding sketch-map (scale 20 miles = 1 in.) showing the spread of cacao swollen shoot [see preceding abstract] in the Gold Coast since 1936.

THOROLD (C. A.). **Cacao diseases in Trinidad.**—*Rep. Cocoa Res. Conf., 1945*, pp. 140–141, 1945.

The incidence of cacao witches' broom [*Marasmius perniciosus*: *R.A.M.*, xxiv, pp. 52, 140] in Trinidad has not changed much in the last few years. It is less severe in certain areas where it has long been present. A few new areas of infection have developed in Tobago, while in Trinidad the disease has become severe in some parts where it was previously unimportant, e.g., at River Estate.

The occurrence of a cacao virus disease in Trinidad has been observed by Posnette [ibid., xxiii, p. 379]. It is confined to the western end of the Northern Range, and does not seem to be of economic importance.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvii, 3, pp. 125–129, 6 figs., 1946.

Notes are given on seed treatment against wheat bunt [*Tilletia caries*], loose smut of wheat [*Ustilago tritici*], oat smuts (*U. avenae* and *U. levis* [*U. kolleri*]), and barley smuts [*U. nuda* and *U. hordei*]. The Lampton variety of oats is stated to be highly resistant to smut; Belar, Buddah, Gidgee, Mulga, and Sunrise moderately resistant; and Algerian, Burke, Fulghum, and White Tartarian susceptible.

Symposium of seed-borne diseases.—*Proc. Canad. phytopath. Soc.*, xii, pp. 18–21, 1944.

F. J. GREANEY states that during the four-year period 1939–43, over 4,000 samples of wheat, oat, and barley seed from all parts of Canada were examined for the presence of disease. While most of the wheat seed carried spores of bunt [*Tilletia caries* and *T. foetida*], only a few bore a spore load of one part or more to 128,000 parts of seed, by weight, and so required treatment. A relatively large proportion, however, of the oat and barley samples were in need of treatment against smut [*Ustilago avenae* and *U. kolleri* on oats and *U. nuda* and *U. hordei* on barley]. Plating tests showed that the most important pathogens present were *Helminthosporium sativum* on wheat and barley, *H. avenae* [*Pyrenophora avenae*] on oats, and *H. teres* on barley. The results of the survey indicate that seed treatment and every other means available should be employed to prevent the interregional distribution of pathogenic seed-borne organisms in Canada.

According to P. M. SIMMONDS, some 18,000,000 bush. wheat seed were sown in Saskatchewan during 1944, while the acreage sown to oats and barley, though smaller, involved the handling of millions of bushels of seed. All seed should be either disease-free or treated for disease control. As Thatcher wheat, which is rather susceptible to bunt, has replaced the resistant Marquis variety in popularity, the possibility of an increase in bunt infection locally has to be borne in mind. At present, bunt is not readily found in most fields and farmers now tend to omit seed treatment. An annual seed examination service would give a complete view of the seed question, on which future work could be based. In Saskatchewan one privately owned laboratory offers to carry out a seed examination service for a small fee, and its work appears to be reliable. This type of service should be extended and controlled by Government regulations.

H. W. Mead describes various types of automatic and power-driven seed-treating machines, together with home-made models, and it has also been demonstrated that seed-grain can be dusted efficiently with a shovel. Tests with wheat, oat, barley, and flax seed demonstrated that the Kemp Model 40 automatic treater, and the same fitted with elevator and bagger, applied dust to 99 per cent. of the seed and gave an even coverage. The Roto-Grav automatic machine covered over 90 per cent. but coverage was uneven. The Minnesota treater gave 78 per cent. coverage, uneven. With the shovel method, 76, 86, and 100 per cent. of the seeds were covered on the first, third, and fourth mixes, respectively.

A. J. Skolko presents some examples from tests made at Ottawa, illustrating the danger involved in importing diseased pea seed, the present status of examinations of imported vegetable seed from the United States, and the effect of flax retting on the amount of seed cracking.

A. A. Hildebrand points out that soy-beans are susceptible to at least 32 parasitic diseases, and states that 11 of a reported total of 13 seed-borne diseases of this host occur in Canada. Mosaic, pod and stem blight [*Diaporthe phaseolorum* var. *sojae*: *R.A.M.*, xxiv, p. 264], and anthracnose [*Glomerella glycines*: ibid., xxii, p. 463] are not amenable to control by surface disinfectants, but control by seed treatment of downy mildew [*Peronospora manshurica*: ibid., xxv, p. 264] and brown spot [*Septoria glycines*: ibid., xxii, p. 463] can, apparently, be highly effective. Recent experiments showed that treatment of mildewed seed of the variety A. K. Harrow with spergon and arasan not only increased emergence by over 10 per cent., but reduced post-emergence diseases in the seedlings. In other circumstances spergon was more effective than either arasan or fermate. For instance, when composite samples of 1942 A. K. Harrow commercial seed of low viability and high disease potentiality were treated with spergon, arasan, and fermate at 2, 1½, and 2 oz. per bush., respectively, percentage emergence was, respectively, 224·7, 87·3, and 77 (untreated control, 100), while percentage incidence of post-emergent disease in the seedlings was, control 22·2, spergon 14·9, arasan 22·5, and fermate 21·6.

Irene Mounce and J. E. Bosher give notes on soil tests and seed treatments in relation to vegetable diseases. J. Walton Groves reports on a number of fungi not previously recorded as seed-borne. T. C. Vanterpool states that the most serious flax disease in Saskatchewan is stem-break and browning (*Polyspora lini*) [ibid., xxiv, p. 506]. Not uncommonly, 30 to 40 per cent. of the flax-seed samples examined in any one year are infected by this fungus, most of the samples also showing a high percentage of seed-cracking [ibid., xxiv, p. 507]. Seed disinfection with new improved ceresan counteracts the harmful effects of cracking, but does not completely prevent *P. lini* from appearing in the crop.

Report of the Milling and Baking Meeting and Seventh Hard Spring Wheat Conference, 1944.—55 pp. [? 1944. Mimeographed. Received 1946.]

The section of this report concerned with diseases in relation to wheat-breeding in the United States (pp. 24–41) contains a discussion by M. N. Levine on the relation of leaf [brown] rust (*Puccinia rubigo-vera tritici*) [*P. triticina*] to spring wheat improvement. The results of large-scale, co-operative varietal tests in the nursery and field from 1940 to 1943, inclusive, showed that none of the six varieties selected for comparative studies maintained even a moderate degree of resistance under all conditions, the infection maxima in the uniform nurseries being 45 per cent. for Merit in Arkansas in 1941, 60 per cent. for Newthatch in Kansas in 1943, 95 per cent. for Pilot in Virginia in 1940, 80 per cent. for Regent in Arkansas in 1941, 90 per cent. for Renown in Virginia in 1941, and 75 per cent. for Rival in Indiana in 1940. In the field Merit sustained the maximum damage of 25 per cent. in North Dakota in 1941, Newthatch and Pilot 33 and 40 per cent., respectively, in Minnesota in 1943, Regent and Renown 28 and 55 per cent., respectively, in Nebraska in 1943,

and Rival 50 per cent. in Minnesota in 1941. During the past 20 years, 299 cultures of the rust were obtained from the four States comprising the spring wheat region, namely, Minnesota, North and South Dakota, and Montana. They fell into 39 different physiologic races [*R.A.M.*, xxiii, p. 58 *et passim*], of which the three most common were 9, 15, and 5, representing, respectively, 20·4, 10, and 5 per cent. of the total, while others requiring notice include 49 (becoming increasingly prevalent since 1941), 13, 19, 28, 31, and possibly 126. So far race 9 is the only one to have been collected in all four States, while 13 and 50 occurred in all except South Dakota. In addition to the standard differential varieties used for physiologic race identification, another 30 or so are to be included in forthcoming trials of material from the northern tier of States, among them being, besides the above-mentioned six, Henry, Mida, Timopheevi × Steinwedel, and two new durums Carleton and Stewart. The complete susceptibility in 1943 of Timopheevi × Steinwedel to races 12, 61, and 107 was surprising as hitherto the crop had been uniformly extremely resistant. Plans for future breeding for resistance to stem [black] rust [*P. graminis*] must, in E. C. Stakman's view, be based on information concerning (1) races which have occurred in the past, (2) their geographical distribution, (3) the population trends over a period of years, (4) the introduction of new races or recurrence of old ones, and (5) the behaviour of the former on the new varieties they are likely to encounter. Racial recognition may be limited by the paucity of differential varieties, more of which are now required to yield the necessary information. Race 15 B, for instance, is distinguishable from the original 15 by its effects on Rival. The importance of barberry eradication as a precaution against the dissemination of new races may be gathered by the fact that a different race occurs roughly once in five isolates from collections taken near these bushes, compared with once in 50 from material originating at a distance from the alternate host.

W. Q. Loegering's greenhouse inoculations of many old and new wheat varieties with up to 40 different physiologic races of *P. graminis* are intended to provide guidance as to the probable field reactions of such varieties to the rust, and to assist in the discovery of breeding material with constitutional resistance to races like 15 B [ibid., xxiv, p. 142]. Red Egyptian Na 101, and K 117 have been found to possess a measure of resistance to the race in question.

Helen Hart's tests with ten races of *P. graminis* on 40 new hybrid wheat varieties, extending from 1939 to 1943 and involving the inducement of artificial epidemics of black rust, have already been noticed from another source [ibid., xxiv, p. 141].

E. R. Ausemus carried out a series of greenhouse tests to determine the seedling reactions of certain wheat varieties to a number of prevalent physiologic races of *P. graminis*, which disclosed new sources of resistance in five Kenya selections (notably Minn. 2693 and 2694), McMurachy, Kenya-Gular, and *T*[*riticum*] *timopheevi* Steinwedel. These lines were crossed with certain varieties possessed of moderate to high field resistance, but the data on the resultant hybrid progeny indicate that the factors controlling the latter type of resistance are not allelic, since susceptible plants arose in the F_2 and later generations. Two Kenya spring wheats are highly resistant to race 15 B and Red Egyptian moderately so. H. A. Rodenhiser briefly summarizes the results of varietal tests and bunt [*Tilletia caries* and *T. foetida*] physiologic race surveys [ibid., xxv, p. 209], and R. W. Smith describes bunt resistance studies in North Dakota, in which specially promising results were given by (Hope–Ridit × Reward) × (Komar–Hussar × Hope–Rel[iance]) and Komar–Hussar × (Hope–Ridit × Reward), both in the F_8, and Nos. 1563 Hope × Turkey–Florence and 1552 Ceres × Pilot, the last-named being a heavy cropper and incidentally resistant to rust [*Puccinia* spp.]. R. H. Bamberg contributes a short discussion of the dwarf bunt [*T. caries*] problem in western Montana and other western States [ibid., xxii, p. 472], where the disease may

cause yield reductions of 75 per cent. The cultivation of three resistant varieties, Relief, Cache [ibid., xxiii, p. 381], and Ridit × Relief, of which the first two had already been released and the third was in an advanced stage of testing at the time of writing, should assist in the control of infection.

R. Sprague reviews the root-rot situation in the hard red spring wheat region, where *Helminthosporium sativum*, *Pythium arrhenomanes*, and *Rhizoctonia* [*Corticium*] *solani* are the chief organisms implicated in the disease complex. The new Mida variety is reasonably tolerant of root rot in central and western North Dakota.

In studies by E. R. Ausemus the maximum resistance to scab (*Gibberella zeae*), both in the field and under tents at the Minnesota Agricultural Experiment Station [ibid., xxiii, p. 478] in experiments from 1933 to 1943 was shown by the Haynes Bluestem and Progress varieties, while a measure of field resistance was characteristic of Rival, Pilot, Hope, Merit, Vesta, and Mercury. Analysis of correlation co-efficients for scab in the field and seed reaction showed moisture and temperature to be of greater importance in the development of infection than the genetic factors controlling reaction to the pathogen. Stem [black] and leaf [brown] rust [*P. graminis* and *P. triticina*] reactions and awnedness were studied in the F_3 lines. Response to black rust in field plants appeared to depend on two or three factor pairs and the other characters on single factor pairs. The sole indication of linkage was between field scab and brown rust reaction in the Rival × Bluestem and H–44–Thatcher × Bluestem crosses.

Between 1930 and 1936, about 250 varieties and hybrid selections were tested by R. G. Shands for scab resistance for one to five years under conditions of high humidity at the Wisconsin Agricultural Experiment Station in comparison with Progress and Marquis, the average incidence of infection in which over the experimental period was 56·6 and 72·5 per cent., respectively. None of the varieties or selections tested contracted significantly less scab than Progress, though among those showing resistance were selections of Illinois No. 1, Haynes Bluestem, Preston, Java, Kearney County Java, Albidum 0721, and several Russian varieties. It may be of interest to note that some of the more resistant lines, including the two Javanese, Progress, and Illinois No. 1 selections, are derived from the Java type which is of Chinese origin, and in this connexion the exploration of the Amur River and Manchuria for resistant types is suggested, the disease having historical importance in that area. Another approach might be made through Denmark, Sweden, and Switzerland, where scab-resistant barleys have been found.

Surveys conducted by E. W. Hanson and J. J. Christensen in 1942 revealed fungal infection in 98 per cent. of all the wheat produced in Minnesota, a relatively high proportion being caused by *Helminthosporium* and *Fusarium* spp. The incidence of seed discoloration ('black point') [associated with *H. sativum* and other fungi] ranged from 1 to 73 per cent., durums being in general much more susceptible than bread varieties; Kubanka [ibid., xxiii, p. 130] sustained the maximum amount of damage in the former and Rival in the latter group. Seed treatment of several varieties with semesan jr. in six localities in 1942 resulted in average stand increases of 8 to 41 per cent. and average reductions in seedling blight of 46 to 83 per cent.

E. W. Hanson presents a table showing the reactions of 19 common spring, five durum, and two winter wheats to a number of diseases, including [unspecified] root and foot rots, from which it appears that the durums are more susceptible to this pathological complex than most of bread varieties, with the exception of Marquillo and Ceres.

Report of the Fifth Hard Red Winter Wheat Improvement Conference, 1945.—63 pp., 1945. [Mimeographed.]

This report includes a number of contributions (pp. 24–32) to the breeding of hard red winter wheat for resistance to various diseases affecting the output of the

crop in the United States [see preceding abstract]. Some of the items have already been noticed from other sources, but attention may be drawn to the following. The most extensive programmes for the development of stem [black] rust [*Puccinia graminis*] resistance are stated by C. O. JOHNSTON to be in operation at Denton, Texas, Manhattan, Kansas, and Lincoln, Nebraska. At these and other co-operating experiment stations combined resistance to stem and leaf [brown] rust [*P. triticina*] is sought, and in many crosses a similar reaction to bunt [*Tilletia caries* and *T. foetida*], loose smut [*Ustilago tritici*], and Hessian fly [*Phytophaga destructor*] is also an objective [*R.A.M.*, xx, p. 107]. Large numbers of strains resistant to both rusts have been developed, among the most promising being two selections of Mediterranean–Hope × Pawnee, which outyielded all the rest in the 1944 rod-row tests.

Hybrid material should be thoroughly tested with the most important physiologic races of the two rusts occurring in the hard red spring wheat area, viz., 9, 15, 44 [ibid., xxv, p. 104], and 126 of *P. triticina* and 56, 17, and 38 of *P. graminis*. The heavier infection of resistant varieties by brown rust in 1944 is thought to be at least partially attributable to the increase in prevalence of races 15 and 126.

Brown necrosis is a problem in the selection of black rust-resistant strains from the progeny of crosses in which Hope or H-44 serve as parents. Light or moderate amounts of the defect do not appear to reduce yields, and some apparently stable selections satisfying the necessary requirements have been made.

K. S. CHESTER describes one of the principal aims of the Oklahoma wheat-breeding project as the combination of resistance to brown rust, the most destructive disease in the State, with other desirable agronomic characters. The best ten out of 700 selections in the F_6 to F_8 from segregating hybrid lines were increased in 1944–5; they were the offspring of compound crosses in which the progenitors were Oro, Tenmarq, Hope, Cheyenne, Hussar, Mediterranean, Nebred, Kanred, Kawvale, and H-44, and united resistance to both rusts with heavy cropping, earliness, stiff straw, grain quality, and the like.

E. S. MCFADDEN states that, of some 2,000 foreign wheat introductions tested in the field at College Station, Texas, during the last eight years, 43 varieties have been found with differing degrees of resistance to *P. graminis*, combined in some cases with a similar response to *P. triticina*.

During the period from 1924 to 44, inclusive, according to M. E. YOUNT, the formerly predominant physiologic races of black rust, 3, 10, 11, 18, 21, 32, 36, 39, and 49, have virtually disappeared from Nebraska, being replaced by 56, 38, and 17. The average number of races occurring annually has declined by roughly 31 per cent., coinciding with a 62 per cent. increase in the number of isolations determined. Even more encouraging is the fact that only two or three races have been present in more than trace amounts of recent years.

I. M. ATKINS reports an estimated annual loss from loose smut during the eight-year period from 1935 of 2,577,000 bush. wheat in Texas, Oklahoma, Kansas, and Nebraska, where the hard winter crop is mainly grown. Of 275 varieties and strains tested for their reactions to *U. tritici* in Texas, Kansas, and Illinois, the soft wheats, Kawvale, Currell, Trumbull, and Leap, showed the maximum degree of resistance. Pawnee is the only hard red winter wheat that has proved highly resistant to loose smut after adequate testing, though a fair degree of resistance has been shown by Hope × Turkey, which reacts similarly to black and brown rusts. In addition to the above-mentioned highly resistant varieties, Newturk, Yogo, and Hope × Mediterranean should provide valuable material for use as parents in crossing experiments.

Varietal reaction differed markedly at the three stations. For instance, the soft Early Premium, Purplestraw, Gasta, Gladden, Forward, Fulhio, and Zimmerman were highly susceptible in Illinois, moderately to slightly so in Kansas, and resistant throughout the experimental period in Texas, whereas Denton, Mediterranean, and

Fultz were highly susceptible in Texas but showed little infection at the other two locations; Gipsy, Minhardi, and Valley contracted the disease in a severe form in Kansas but were not appreciably damaged elsewhere. These observations emphasize the risk of sending infected seed from one part of the country to another.

Among the wheat varieties most resistant to speckled leaf blotch (*Septoria tritici*) in Kansas [ibid., xxiv, p. 12] H. Fellows found Red Chief, Ukraine, Wisconsin Pedigree No. 2, Brill, Mediterranean, Valley, Jenkin, Triplet, Yorkwin, and Minhardi, followed by Sibley 81, Bald Rock, Denton, Nabob, Gladden, Prairie, Thorne, and Illinois, while promising hybrid combinations included Gelow × Oro F_7, Clarkan × Eureka F_3, *Triticum vulgare–T. timopheevi* × *T. vulgare*, Marquillo–Oro × Hope–Kawvale, and Marquillo × Oro F_{12}.

Four new recommended Wheats which combine stem rust resistance with yield and quality.—*Agric. Gaz. N.S.W.*, lvii, 1, pp. 3–6, 4 figs., 1946.

Of these four new wheats recommended for sowing the wheat areas of New South Wales, Gabo (a Bobin selection × Gaza × Bobin selection) is remarkably resistant to the known races of stem [black] and leaf [brown] rusts [*Puccinia graminis* and *P. triticina*]; it is an early variety, for which late sowing is recommended to counteract its moderate susceptibility to flag smut [*Urocystis tritici*]. Kendee (Dundee × Kenya (U.A. No. 745)), suitable for mid-season planting in the north-western areas, is resistant to black rust and flag smut, but susceptible to brown rust. Yalta (Kenya × Pusa 4 × Dundee), a main-crop variety, shows considerable resistance to black rust, average susceptibility to brown rust, and high resistance to flag smut. Celebration (Double Cross × Dundee × Dundee), a late-maturing main crop variety, resists flag smut and black rust vigorously. [Notes on other recommended wheat varieties are given on pp. 10–11.]

Hansing (E. D.) & Melchers (L. E.). **Further studies on the occurrence and distribution of physiologic races of Tilletia foetida in Kansas.**—*Trans. Kans. Acad. Sci.*, xlviii, 1, pp. 71–77, 1 fig., 1945.

The differential wheat varieties, Chiefkan, Ridit, Oro, Hussar, White Odessa, and Canus, were inoculated with 100 collections of *Tilletia foetida* from 57 counties of Kansas to determine the number, prevalence, and distribution of physiologic races in the State [*R.A.M.*, xxi, pp. 284, 329]. Of these, 82 were classified as L-3, one as L-4, seven as L-5, and ten as L-7.

Glynne (Mary D.), Dion (W[endy] M.), & Weil (J. W.). **The effect of eyespot (Cercosporella herpotrichoides Fron) on Wheat and the influence of nitrogen on the disease.**—*Ann. appl. Biol.*, xxxii, 4, pp. 297–303, 1 pl., 6 graphs, 1945.

With a view to determining how the considerable reduction in the yield of wheat due to *Cercosporella herpotrichoides* [*R.A.M.*, xxiv, p. 183] is caused, the effect of eyespot throughout the season on wheat receiving different amounts of nitrogen was studied in pot experiments.

The close study of pot plants at short intervals confirmed many general impressions obtained from field observations. Plants inoculated in December showed chlorosis of the outer leaves in February followed by the death of many plants; straggling, whiteheads, delay in flowering and in growth, reduction in final height and a more uneven crop, reduction in yield of straw and a greater reduction in that of grain were observed among the survivors. The application of nitrogen reduced, and in some cases, eliminated, these adverse effects.

In comparing these results with those in the field it should be remembered that the effect of the disease in pots is likely to be greater than in the field.

In the uninoculated, high-nitrogen series of pot experiments, the yield of grain amounted to 27 cwt. per acre and in the low-nitrogen inoculated pots only to about

9 cwt. per acre. These results, and the quality of grain, as shown by the percentage of tail corn, were similar to those obtained from moderate crops in the field. In the case of the inoculated low-nitrogen series, however, the percentage of tail corn was so high that the loss of dressed corn was considerably greater than that estimated from total weight.

In the field applications of nitrogen were found to have two opposing effects on eyespot. The more luxuriant crops maintain a damper atmosphere near soil-level, which favours the spread and development of the disease. At the same time, the increased tiller production resulting from the application of nitrogen appears to enable the plant to discard the most severely diseased tillers and so reduces the intensity of the infection at harvest. These considerations, necessitating further study, are thought to account for the discrepancy in field observations in the past, notably of Sprague and Fellows [ibid., xiv, p. 230], Hoffman [ibid., xiv, p. 229], Weigert and Weizel [ibid., xiv, p. 351], Oort [ibid., xvi, p. 29], and Meijers (*Versl. LandbDir., 's Grav.*, xliii, (8) A, pp. 271–311.

Field records and pot experiments show that the effect of nitrogen in increasing yield and reducing the damage done by eyespot considerably outweighs its ill effects in increasing the spread of the disease. Its application to infected crops appears to be particularly desirable, provided that general lodging of the crop is not induced, a probability which, as distinct from straggling, can be reduced by using short, strong-strawed varieties.

Klotz (L. J.) & Middleton (J. T.). **Copper spray damage to Citrus.**—*Citrus Leaves*, xxv, 11, 18, 26, 1945. [Abs. in *Chem. Abstr.*, xl, 3, p. 666, 1946.]

A release of soluble copper is suggested as the principal cause of damage to citrus in some parts of California following treatment with Bordeaux mixture [cf. *R.A.M.*, xxv, p. 65], and experiments are in progress to find substitutes for copper sprays. The following have given encouraging results in brown rot [*Phytophthora citrophthora* and *P. parasitica*] control: dithane [disodium ethylene bisdithiocarbamate: ibid., xxv, p. 215], spergon, and zerlate-milban.

Fawcett (G. L.). **Notas sôbre la podredumbre de las raicillas o 'tristeza' de los Naranjos.** [Notes on the rootlet rot or 'tristeza' of Oranges.]—*Rev. industr. agríc. Tucumán*, xxxv, 1–3, pp. 33–35, 1945.

The form of orange root rot known as 'tristeza' has not yet been detected in Tucumán, but its presence in other parts of Argentina (Corrientes, Entre Ríos, and Misiones) renders most probable its subsequent extension into the first-named Province. The relevant literature is briefly surveyed and Webber's theory of the virus origin of the disease [*R.A.M.*, xxv, p. 111] accepted as the most plausible explanation of its etiology.

Eaton (F. M.) & Rigler (N. E.). **Influence of carbohydrate levels and root-surface microfloras on Phymatotrichum root rot in Cotton and Maize plants.**—*J. agric. Res.*, lxxii, 4, pp. 137–161, 5 figs., 1946.

Investigations are described on the possible competitive influence of microbial elements of the rhizosphere of *Gossypium hirsutum* on *Phymatotrichum omnivorum*. In pot and field experiments with plants of fruiting age low carbohydrate concentration of the root bark [*R.A.M.*, xix, p. 592 and cf. below, p. 318] has been found directly associated with the susceptibility of cotton to *P. omnivorum*. Plants with a low carbohydrate concentration, brought about by artificial interference with photosynthesis, died within two weeks after infection, with intermediate concentration death was delayed for some time, and a high concentration kept them alive. If a high concentration of carbohydrates was kept up for some months, *P. omnivorum* was eliminated from the roots and healthy growth was promoted.

Ultimate recovery of the plant is thought to be due to the increased carbohydrate ratio and the loss of water supply accompanying the death of the lower roots.

At the same time, prolonged experiments have shown that *P. omnivorum* has developed well in culture on high-carbohydrate substrata, and if the organism were present alone when tissues are invaded its growth should be encouraged rather than arrested by a more nutrient substratum. However, the saprophytic organisms encountered under field conditions are considered to confront *P. omnivorum* with competitive conditions of growth on and within the plant tissue. The differences in the carbohydrate concentration cause alteration in the microbial population. It is, therefore, thought likely that an antibiotic effect, amounting with high concentrations to inhibition of *P. omnivorum* and notably changing the microbial equilibria on the surfaces of the *Gossypium* roots, may be operative. The high resistance of seedling cotton, on the other hand, cannot be attributed to the effect of carbohydrate concentration, but rather to a different microbial balance in the rhizosphere.

It would seem that the most productive strains should be the most susceptible and that any field practices which increase yield (and therefore lower carbohydrate concentration in the roots) should also encourage root rot. It appears, however, that the net result in the field is usually a gain even when more plants die.

A similar reaction was observed between root-surface saprophytes and the pathogenic virulence of *P. omnivorum*, maize being quickly destroyed by the fungus on sterile sand-bentonite substrata, and maize roots on natural field substrata resisting attack although closely engaged by hyphae of *P. omnivorum* for considerable distances.

Plant diseases. Diseases of Gladiolus. *Agric. Gaz. N.S.W.*, lvii, 2, pp. 93–97, 9 figs., 1946.

Brief, popular notes are given on the symptoms and control of the following diseases affecting the corms and foliage of *Gladiolus* in New South Wales: scab (*Bacterium marginatum*) [*R.A.M.*, xix, p. 22], hard rot (*Septoria gladioli*) [ibid., xxi, p. 130], *Botrytis* core rot (*B.* sp.) [ibid., xxiv, p. 373], which is not important in the metropolitan area, but may give trouble in coastal and highland regions, *Fusarium* rot, producing lesions on the corms [ibid., xxiii, p. 300], dry rot (*Sclerotinia gladioli*) [ibid., xxiv, p. 103] (not common or widely distributed locally), mosaic [ibid., vii, p. 517; xxiii, p. 488], and possibly yellows (*F. oxysporum* var. *gladioli*) [ibid., xxiv, p. 418], the presence of which in New South Wales has not yet been definitely established.

Limasset (P.). **Les maladies à virus du Dahlia.** [*Dahlia* virus diseases.]—*Rev. hort., Paris*, N.S., xxx, 1, pp. 11–14, 1 diag., 1946.

A scheme of sanitary selection by protracted isolation and testing of stock is propounded for the control of the *Dahlia* viruses, mosaic and [tomato] spotted wilt [*R.A.M.*, xxiv, p. 510], which are sufficiently serious in France to demand drastic measures for their elimination.

Castellani (E.). **Su due malattie del Cyperus rotundus L.** [On two diseases of *Cyperus rotundus* L.]—Reprinted from *Agricoltura colon.*, xxxvi, 6, 7 pp., 3 figs., 1942. [Received February, 1946.]

After stating that the noxious weed *Cyperus rotundus* constitutes a danger to the cotton crops in the Tessenei area of Eritrea, the author describes two diseases of this host found locally. The more prevalent was a rust due to *Puccinia canaliculata* [see next abstract]. The second disease, associated with the first, was a smut identified as *Cintractia peribebuyensis*. Both diseases, especially the latter, appear

to offer some possibility of biological control of the weed, though their importance must not be over-estimated in this respect, since the spread of the host seems to be chiefly due to carriage of the small tubers by flood water.

CASTELLANI (E.). **Sulla presenza di teleutoconidi pluricellulari in 'Puccinia canaliculata' (Schw.) Lagerh.** [On the presence of pluricellular teleutospores in *Puccinia canaliculata* (Schw.) Lagerh.]—*Nuovo G. bot. ital.*, N.S., xlviii, pp. 658–661, 1 fig., 1941. [Received February, 1946.]

The author records the occurrence in October and November, 1937, of tricellular teleutospores of *Puccinia canaliculata* [see preceding abstract] on *Cyperus rotundus* in different parts of Eritrea, over 5 per cent. of the spores being so formed. A few mesospores were also present.

COOLEY (J. S.). **Root diseases of deciduous fruit trees.**—*Bot. Rev.*, xii, 2, pp. 83–100, 1946.

The literature on the fungal, bacterial, and non-parasitic root diseases of deciduous fruit trees is reviewed with special emphasis on their pathological (rather than mycological) and remedial aspects and according particularly comprehensive treatment to those occurring in the eastern States of the American Union. Most of the more recent papers included in the bibliography of 59 titles have already been noticed from the original sources.

Symposium on virus diseases of tree fruits.—*Proc. Canad. phytopath. Soc.*, xii, pp. 21–23, 1944.

G. H. BERKELEY and R. S. WILLISON state that whereas only two virus diseases of stone fruits, peach yellows and little peach, were known to occur in Ontario in 1935, at least 15 are found there now on peach, plum, and cherry. The only serious ones, apparently, are X disease of peach [*R.A.M.*, xxii, p. 162], yellows [ibid., xxiii, p. 234] and necrotic ring spot [cf. ibid., xxii, p. 421] of sour cherry, and plum dwarf [ibid., xxiii, p. 492]. J. F. HOCKEY points out that two virus diseases of apple about which more information is desirable are mosaic [ibid., xxiii, p. 134] and false sting [ibid., xxii, p. 438]. T. B. LOTT discusses the present situation as regards virus diseases of tree fruits in the interior of British Columbia. Cherry-growers have suffered greater losses from crinkle [ibid., xx, p. 6; xxiii, p. 392] than from any other virus disease of this host.

FISCHER (H.). **Eine seltene Fäulnis bei Birnen.** [A rare Pear rot.]—*Schweiz. Z. Obst- u. Weinb.*, lv, 11, pp. 223–225, 2 figs., 1946.

Stored pears in Switzerland are occasionally attacked by *Cladosporium herbarum*, which usually enters either near the pedicel or calyx or through an insect gallery and induces a deep black discoloration of the flesh with a glassy outer layer 2 mm. in thickness. Apples may be similarly affected, but as the disease does not usually occur until after the beginning of January, and then only very exceptionally, the damage from this source is inconsiderable.

LAPÉDAGNE (H.). **Les Cognassiers disséminateurs de la moniliose.** [Quince trees as disseminators of moniliasis.]—*Rev. hort., Paris*, N.S., xxx, 3, pp. 44–45, 1946.

During the autumn of 1945 the writer visited a large number of orchards in the south-west of France, where he found an alarmingly high incidence of *Monilia* [*Sclerotinia fructigena* and *S. laxa*] on peaches, plums, and other fruits [*R.A.M.*, xix, p. 105]. Quinces were shown to serve as the foci of infection, the fruits remaining on the trees and photographed in December bearing sufficient spores to contaminate

the entire district. The trees are grown locally solely as orchard boundaries, no use whatever being made of the fruits, but a proposal for their treatment or eradication at a recent meeting of the Haute-Garonne Horticultural Society encountered strong opposition. It is now suggested that the trees should be compulsorily trimmed to hedge height in order to prevent flowering and the consequent production and spread of inoculum.

Chowdhury (S.). **Wilt of Pineapple in Assam.**—*Curr. Sci.*, xv, 3, p. 82, 1946.

A wilt of pineapple similar to that reported from Queensland as due to *Phytophthora cinnamomi* [*R.A.M.*, xiv, p. 457] has been responsible for considerable damage in Assam of recent years, especially during periods of excessive rainfall. Infection is most prevalent on one- to two-year-old plants and invariably results in cessation of growth, both of the suckers and of the parent plant. The leaves assume a drab-olivaceous tinge, becoming flaccid and dropping, this foliar collapse being the most striking symptom of the early stage of the disease. Subsequent progress of the wilt is slow, and complete shrivelling of the leaves, from the tips downwards, may occupy a period of months. The development of immature fruits is arrested and they colour prematurely, their texture being spongy and the flavour subacid, so that they are commercially valueless. The withered fruit stalks maintain their rigidity, and the fruits can only be dislodged from the pedicels by means of a twisting movement. Extensive root decay may be well advanced before any external symptoms are apparent. The causal organism was identified as a strain of *P. parasitica* and its pathogenicity established by inoculation experiments.

Adsuar (J.). **Transmission of Papaya bunchy top by a leaf hopper of the genus Empoasca.**—*Science*, N.S., ciii, 2671, p. 316, 1946.

The author has recently obtained evidence of the successful transmission of papaw bunchy top by a leafhopper apparently identical with that used by Jensen [*R.A.M.*, xix, p. 201], and later described by Oman as *Empoasca papayae*. Seventy-one out of 90 healthy trees exposed to leafhoppers from diseased plants showed symptoms of bunchy top in about six weeks. The unexposed controls remained healthy.

Ciferri (R.). **General remarks on the technique of testing fungicides 'in vitro'.**—*Int. Bull. Pl. Prot.*, xviii, 5–6, pp. 33 M–37 M, 1944.

Ciferri (R.) & Baldacci (E.). **Causes of error in the 'in vitro' control method of fungicides and description of the Palagi–Terzano 'nebulization bench'.**—Ibid., xviii, 9–10, pp. 65 M–72 M, 3 figs., 1944.

Ciferri (R.) & Baldacci (E.). **The fungicidal power of lime and inert powders.**—Ibid., xviii, 11–12, pp. 81 M–91 M, 1944.

Ciferri (R.). **Checking of accuracy in testing fungicides 'in vitro', and examples particularly as applied to Alternaria, tenuis type.**—Ibid., xix, 3–4, pp. 17 M–21 M, 1945.

Ciferri (R.) & Baldacci (E.). **Comparative experiments on the toxicity of different metals on Alternaria, tenuis type, and Plasmopara viticola.**—Ibid., xix, 5–6, pp. 33 M–37 M, 1945.

These are English versions of Italian papers, already noticed from another source [*R.A.M.*, xxv, pp. 221–224], dealing with the testing of the fungicidal efficacy of spray mixtures.

Insecticides, insect repellents, rodenticides and fungicides of I.G. Farbenindustrie A.G., Elberfeld and Leverkusen, Germany, 19–30 May, 1945.—Item No. 24, File No. xxvi–73. Combined Intelligence Objectives Sub-Committee, 48 pp., London, H.M. Stationery Office, 1945. [Mimeographed.]

On p. 15 of this report Dr. S. A. Hall, United States Civilian Office of the Chief Surgeon, states that the sodium salt of 3-chloro-4-hydroxyphenyl-diazosulphonic acid, prepared by Dr. Urbschat at Leverkusen and tested by Dr. Bonrath, gave perfect control of loose smut of oats [*Ustilago avenae*] and *Fusarium nivale* [*Calonectria graminicola*] on rye. The seed-grain is immersed for 30 minutes in a 0·1 per cent. aqueous solution of the compound.

Haskell (R. J.). **Extension work in plant pathology in the United States.**—*Proc. Canad. phytopath. Soc.*, xii, pp. 13–14, 1944.

In this summary of a talk given before the symposium on extension work in plant pathology of the Canadian Phytopathological Society on 26 June, 1944, the author briefly outlines the organization of extension work in the United States, which began with the agricultural societies and farmers' institutes and was later taken up by certain agricultural colleges. At present, each State has its own extension service, with the necessary directors, leaders, and specialists, whose headquarters are at the State College. Each county has its agricultural agents. The Federal Office in Washington is modelled on those of the different States. Extension work in plant-disease control is now conducted in 22 States, which employ 36 full- or part-time specialists.

Trotter (A.). **La fitopatologia nel quadro del popolamento biogeografico della Libia.** [Phytopathology in relation to the biogeographical colonization of Libya.]—*Nuovo G. bot. ital.*, N.S., xlix, 3–4, p. 491, 1942. [Received April, 1946.]

Libya can be considered, in relation to the pathology of cultivated plants, as a series of cultivated islands separated by vast steppes or deserts. The entry of new parasites is impeded by the isolation of the territory by sea and desert, but may be effected by the casual importation of plants. *Exoascus* [*Taphrina*] *deformans*, *Ustilago avenae*, and other fungi have been introduced into Libya in this way.

Florey (Sir H. W.). **Some antibiotics, with special reference to penicillin.**—*Mem. Manchr lit. phil. Soc., 1943–45*, lxxxvi, pp. 191–204, 1945.

This is a general survey of outstanding developments in the production and application of antibiotics, with special reference to penicillin.

Frieden (E. H.). **The nature and action of the antibiotics.**—*Tex. Rep. Biol. Med.*, iii, 4, pp. 569–646, 1 pl., 1 graph, 1945.

The author describes this paper as 'an attempt to correlate the most important available data relating to the nature, biological activity, and mode of action of the antibiotics'. Without claiming to be exhaustive, the discussion is believed to include essentially all the specific chemical entities that have been shown to exhibit antibiotic activity. An 11-page bibliography is appended.

Mohan (R. R.), Rao (T. N. R.), & Sreenivasaya (M.). **Supplemental value of bran extract in penicillin production.**—*Curr. Sci.*, xv, 4, pp. 108–109, 1946.

S. S. Rao has shown (*Nature, Lond.*, cliv, p. 83, 1944) that the addition of moist wheat bran to the medium increases penicillin production by *Penicillium notatum* and curtails the incubation period. In connexion with a comprehensive programme for the investigation of the microbiologically active principles of wheat bran

[cf. *R.A.M.*, xxiv, p. 240], the writers studied the effect of acid alcohol extracts of the material on the output of penicillin by the mould (*J. sci. industr. Res., India*, iv, p. 377, 1945). In their experiments the use of a bran extract supplement at graded dosages ranging from 0·2 to 0·8 mg., calculated on the basis of total nitrogen, resulted in a 60 per cent. increase of penicillin, the climax being reached on the fifth to sixth day.

Mukherjee (S. L.) & Sarkhel (B. C.). **Synthetic liquid penicillin medium with glycerine as the sole source of carbon atom.**—*Nature, Lond.*, clvii, 3988, p. 440, 1946.

The authors record the use of glycerine instead of the more expensive glucose in the following synthetic liquid medium for penicillin production: sodium nitrate 3 gm., potassium chloride 0·5 gm., hydrated magnesium sulphate 0·5 gm., hydrated ferrous sulphate 0·01 gm., potassium dihydrogen phosphate 1 gm., 'bacto-peptone' 10 gm., glycerine 20 or 40 c.c. according as 2 or 4 per cent. V./V. was desired, and distilled water to make 1 l. Very satisfactory results followed when the distilled water was replaced by 1,000 c.c. extract from 100 gm. wheat bran. For each sowing bottle 200 c.c. of this medium were employed. *Pen[icillium] notatum*, G.C. 419, was used and antibacterial activity was recorded in duplicate in standard nutrient broth medium with Oxford A. *Staph[ylococcus] aureus* strain in the usual manner. The 4 per cent. glycerine medium gave an anti-bacterial activity of 350 units after 8 days (pH 6).

Backus (M. P.), Stauffer (J. F.), & Johnson (M. J.). **Penicillin yields from new mold strains.**—*J. Amer. chem. Soc.*, lxviii, 1, pp. 152–153, 1946.

Spores from a monoconidial isolate of *Penicillium chrysogenum* X–1612 [*R.A.M.*, xxv, p. 130] subjected to ultra-violet irradiation gave rise to a new strain, Wis. Q 176, which has consistently surpassed its parent in penicillin production, usually by a considerable margin.

Wikén (T.). **Studies on the effect of a glass factor upon the formation of antibiotic substance by a member of the Penicillium chrysogenum Thom series.**—Reprinted from *Ark. Bot.*, xxxiii A, 3, 44 pp., 2 figs., 12 graphs, 1946.

When a representative of the *Penicillium chrysogenum* series was grown on synthetic media in vessels made of M (a Swedish resistant product), and Jena, or quartz glass, the first-named caused irregularities in the initiation of the formation of the antibiotic proper to the mould and depressed and curtailed its inhibitory activity in respect of *Staphylococcus aureus*. On the other hand, M glass markedly promoted the growth of the fungus, both by expediting mycelial development and by increasing the yield of dry matter.

Hanson (Hazel J.), Myers (W. G.), Stahly (G. L.), & Birkeland (J. M.). **Variation in Penicillium notatum induced by the bombardment of spores with neutrons.**—*J. Bact.*, li, 2, pp. 9–18, 1 fig., 1 graph, 1946.

Marked variation appeared in cultures from spore suspensions of *Penicillium notatum* exposed to bombardment with slow neutrons from a 42-in. cyclotrone for periods of one hour to 134 days, the number of mutants increasing *pari passu* with the prolongation of the time of exposure (*Science*, N.S., ci, pp. 357–358, 1945).

The mutants have almost invariably bred true throughout a number of successive transfers. A screening test, surface cultivation, and preliminary trials in submerged cultivation showed the variant strains to differ greatly in their capacity for penicillin production, some having entirely lost this property, whereas the yields of others considerably exceeded those obtained from the parent culture.

Waksman (S. A.), Bugie (Elizabeth), & Schatz (A.). **Isolation of antibiotic substances from soil micro-organisms, with special reference to streptothricin and streptomycin.**—*Proc. Mayo Clin.*, xix, pp. 537–548, 1944.

The production of streptothricin and streptomycin [see next abstracts] by certain Actinomycetes is considerably influenced by the composition of the medium and growth conditions. The presence of a growth-promoting substance, such as is found in meat extract, is essential for the production of streptomycin, but not for that of streptothricin. Tryptone or peptone and glucose favour the formation of both.

Both streptomycin and streptothricin are stable against destruction by various organisms; both are sensitive to increasing acidity and the presence of glucose; both resist high temperatures. Both act on various Gram-positive and Gram-negative bacteria, but streptomycin is more active against some bacteria of each group, e.g. *Bacillus mycoides* and *Mycobacterium tuberculosis* in the former, and *Proteus vulgaris* and *Pseudomonas aeruginosa* in the latter, than is streptothricin. Both show limited toxicity to animals and marked activity *in vitro* against various Gram-positive and Gram-negative bacteria.

Waksman (S. A.), Reilly (H. Christine), & Schatz (A.). **Strain specificity and production of antibiotic substances. V. Strain resistance of bacteria to antibiotic substances, especially to streptomycin.**—*Proc. nat. Acad. Sci., Wash.*, xxxi, 6, pp. 157–164, 1945.

In the fifth paper of this series [cf. *R.A.M.*, xxiv, pp. 426, 463] evidence is presented showing that different strains of the same bacterial species may vary widely in sensitivity to streptomycin [see preceding abstract].

A strain of *Proteus vulgaris* resistant to streptomycin showed some resistance to streptothricin but none to clavacin. A strain of *Staphylococcus aureus* slightly resistant to streptomycin showed no resistance to streptothricin. Strains of *S. aureus* showed highly resistant to streptomycin, no increased resistance to clavacin and only faintly increased resistance to streptothricin.

Bondi (A.), Dietz (Catherine C.), & Spaulding (E. H.). **Interference with the antibacterial action of streptomycin by reducing agents.**—*Science*, N.S., ciii, 2674, pp. 399–401, 1946.

The anti-bacterial activity of streptomycin in infusion agar cultures of *Escherichia* [*Bacterium*] *coli* and other bacteria was shown to be diminished by anaerobic incubation for 24 hours at 37° C. The bacteriostatic properties of the antibiotic in respect of *Bact. coli* were also reduced by the presence in the medium of cysteine, sodium thioglycocollate (both at 0·1 per cent.), stannous chloride, sodium bisulphite, sodium hydrosulphite (all at 0·05 per cent.), sodium formate, and sodium thiosulphate (both at 0·5 per cent.), the first-named being the most active antagonist.

Atkinson (Nancy). **Toadstools and Mushrooms as a source of antibacterial substances active against Mycobacterium phlei and Bact. typhosum.**—*Nature, Lond.*, clvii, 3988, p. 441, 1946.

In a survey of over 200 kinds of mushrooms and toadstools collected in South Australia, anti-bacterial activity of aqueous extracts was observed in several members of *Cortinarius* and one of *Psalliota*. All the active extracts inhibited the growth of *Staph*[*ylococcus*] *aureus*, but those of two only showed wider activity, viz., those of *C. rotundisporus* and *P. xanthoderma* inhibited *S. aureus*, *Bact*[*erium*] *typhosum*, and *Myco*[*bacterium*] *phlei*.

The extracts from *C. rotundisporus* were more active against *S. aureus* than against *Bact. typhosum*, whereas those from *P. xanthoderma* were about equally

active against both. The activity of all the extracts against *M. phlei* was well marked, but weaker than that shown against *S. aureus*. The extracts of *Psalliota* were more readily inactivated by heat and alkalinity than were those of *Cortinarius*.

HOLLANDE (A. C.). **Lyse massive des bacilles de Koch chez le cobaye après traitement à la clitocybine. Pouvoir inhibiteur de ce produit vis-à-vis du bacille typhique, du colibacille, de Brucella abortus etc.** [Mass lysis of Koch's bacilli in the guinea-pig after treatment with clitocybin. Inhibitory property of this product in respect of the typhus bacillus, the coli bacillus, *Brucella abortus*, &c.]—*C.R. Acad. Sci., Paris*, ccxxi, 13, pp. 361–363, 3 figs., 1946.

This is a preliminary note on the antibiotic properties of clitocybin in respect of Koch's bacillus [*Mycobacterium tuberculosis*] and other pathogenic micro-organisms [see next abstract].

HOLLANDE (A. C.). **L'action de la clitocybine sur le bacille tuberculeux et autres microbes.** [The action of clitocybin on the tubercule bacillus and other microbes.]—*Atomes, 1946*, 3, pp. 1–5, 5 figs., 1946.

Clitocybe candida, an edible fungus occurring in Alpine meadows at an altitude of 800 to 1,000 m. in the Isère Department, France, yields an extract, clitocybin, which was experimentally shown to exert a bacteriostatic effect on *Staphyloccus aureus*, the tubercle bacillus [*Mycobacterium tuberculosis*] (which was particularly sensitive), *Brucella abortus*, the coli bacillus [*Bacterium coli*], and the pyocyanic bacillus [*Bacillus pyocyaneus*]. After extraction by sulphuric ether and purification, clitocybin, redissolved in water, is innocuous to guinea-pigs. Progressive and total lysis of *M. tuberculosis* was observed in infected guinea-pigs treated with the antibiotic.

Report on visit to the Zellstoffefabrik A.G. (Waldhof), Kelheim, near Regensburg.—Final Report No. 5, Item No. 22, British Intelligence Objectives Sub-Committee, 3 pp., London, H.M. Stationery Office, 1945. [Mimeographed.]

W. G. Campbell and H. J. Bunker visited the Waldhof cellulose factory, Kelheim, near Regensburg, on 9th August, 1945, and report as follows on yeast production, which was begun in 1944. The works are engaged primarily in the preparation of wood pulp by the ordinary sulphite process, the waste liquor thus obtained being fermented by *Torula* [*Torulopsis*] *utilis* [*R.A.M.*, xxv, p. 270]. Fermentation is continuous, the flow through the fermentation vessel containing 50 to 55 cu.m. liquid and 200 to 250 cu.m. foam being 10 cu.m. an hour. Under normal conditions the average output of the plant was 7 tons a day, and the material was used both for human consumption and for fodder.

Developments in pure and applied microbiology in Germany (American, British, and French zones) during world war II. Final Report No. 236, Item No. 22, British Intelligence Objectives Sub-Committee, pp. 21–49, London, H.M. Stationery Office, 1945. [Mimeographed.]

Full particulars are given of the information obtained in 1945 by A. K. Balls (United States Department of Agriculture), D. H. F. Clayson (British Ministry of Food), and G. A. Ledingham (Canadian Department of Reconstruction) relative to the production of *Torula* [*Torulopsis*] *utilis* [see preceding abstract] on wood sugars by the Bergius process at the South German Wood Saccharification Plant at Regensburg, and by the Scholler process at the Holzminden Sugar and Chemical Industry Works, the development of *Oidium* [*Oospora*] *lactis* on waste sulphite

liquor at the Lenzing (Austria) cellulose and paper factory, and the laboratory and pilot plant-scale production of fat from *O. lactis* at the Association of Biological Chemistry, Bad Tölz. At the Prussian Dairy Experiment and Research Station strains of *Fusarium*, *Candida*, *Oidium* [? *Oospora*], *Endomyces*, and *Rhizopus* were being successfully utilized for protein production, and the firm of C. H. Boehringer, Jr., Oberingelhein, near Bingen, were manufacturing gluconic and citric acids through the action of *Aspergillus niger* on acid-hydrolysed potato starch solution and beet molasses, respectively.

Peyronel (B.). **Ricerche sulla simbiosi micorrizica nelle Epatiche.** [Researches on mycorrhizal symbiosis in the Hepaticae.]—*Nuovo G. bot. ital.*, N.S., xlix, 3–4, pp. 362–382, 4 figs., 1942. [Received April, 1946.]

After reviewing and discussing earlier studies by different workers on the mycorrhiza of the Hepaticae the author describes his own investigations. These showed that in the thalli of *Fegatella conica*, *Lunularia cruciata*, *Pellia fabbroniana*, and *P. neesiana* there is a double infection due to (1) a Phycomycete with arbuscules and vesicles [? *Rhizophagus*: *R.A.M.*, xviii, p. 470; xxv, p. 178] which penetrates the rhizoids and invades the amyliferous parenchyma of the thallus, and (2) probably a *Rhizoctonia* localized in the rhizoids and the dead parts of the thallus. The first probably belongs to the Endogonaceae or to *Mortierella*. A *Mortierella* with a mycelium closely resembling that of the endophyte was isolated from thalli of *F. conica*.

In the leafy Hepaticae only the *Rhizoctonia* was found. Infection by the Phycomycete was closely connected with environmental factors. Lack of humus and of light reduced infection, while the presence of humus favoured it. Humidity reduced infection, as a rule. The relations between Hepaticae and the Phycomycete are generally those of symbiosis.

A bibliography of 86 titles is appended.

McClintock (Barbara). **Neurospora. I. Preliminary observations of the chromosomes of Neurospora crassa.**—*Amer. J. Bot.*, xxxii, 10, pp. 671–678, 3 figs., 1945.

Beadle (G. W.) & Tatum (E. L.). **Neurospora. II. Methods of producing and detecting mutations concerned with nutritional requirements.**—Ibid., xxxii, 10, pp. 678–686, 1945.

In the first contribution observations are reported on the chromosomes and nuclei in the ascus from fertilization to spore formation of normal strains and three irradiation-induced mutants of *Neurospora crassa* [*R.A.M.*, xxiii, p. 268]. In the second the nutritional requirements and genetic differences induced in mutant strains of *N. crassa* and *N. sitophila* by X-rays, ultra-violet radiation, or neutron bombardment [cf. above, p. 307] were studied.

White (N. H.). **Biochemical contributions to the knowledge of fungal diseases of plants.**—*Aust. chem. Inst. J.*, xii, 9, pp. 291–295, 1945.

The literature on three examples of fungal diseases of plants is reviewed to illustrate the application of biochemistry to these problems, namely, onion smudge (*Colletotrichum circinans*) [*R.A.M.*, xii, p. 672], tomato vascular wilt (*Fusarium* [*bulbigenum* var. *lycopersici*]) [ibid., xxiii, p. 244], and the obligate parasites, rusts and powdery mildews. All are characterized by the production of phenolic compounds resulting from the activity of the oxidizing enzyme systems in plant tissues. It is suggested that this process is the result of decompensated respiration, a phenomenon accompanying various types of parasitism in plants.

Baldacci (E.). **La resistenza delle piante alle malattie.** [The resistance of plants to diseases.]—261 pp., 14 figs., Genova, Società Anonima Editrice Dante Alighieri (Albrighi Segati, e C.), 1942. 35 L. net. [Received March, 1946.]

In the first part of this book, the author discusses in detail various immunological hypotheses that have been put forward by different workers to account for the resistance of plants to disease. He then deals with the known factors of resistance, particularly defence against penetration and defensive reactions during infection by certain types of disease [cf. *R.A.M.*, xviii, p. 757], including virus diseases. In the third section, attention is paid to variations in resistance induced by mineral nutrition, the application of organic and inorganic compounds, and in relation to photosynthesis, and other factors. The work concludes with a brief critical review of the available experimental data.

Stevenson (F. J.). **Potato breeding, genetics, and cytology: review of recent literature.**—*Amer. Potato J.*, xxii, 2, pp. 36–52, 1945.

Among the 37 papers listed and briefly summarized in this review of recent literature on various aspects of potato-breeding are several concerned with resistance to virus diseases, late blight (*Phytophthora infestans*), scab (*Actinomyces scabies*), etc., most of which have already been noticed from the original sources.

Hansen (H. P.). **Studier over Kartoffelviroser i Danmark III. Om betingelserne for virusspredning samt kortlægning af deres geografiske fordeling.** [Studies on Potato viruses in Denmark III. On the conditions for virus dissemination, with charting of their geographical distribution.]—Thesis, Veterinary and Agricultural College, Copenhagen, 134 pp., 1 diag., 10 graphs, 7 maps, 1941. [English summary. Received April, 1946.]

Continuing his studies on potato viruses in Denmark [*R.A.M.*, xxii, p. 36; cf. also ibid., xxv, p. 178], the author carried out a number of field experiments, covering a period of three years, on the factors affecting the behaviour of the aphid, *Myzus persicae*, responsible for the dispersal of virus Y. The trials were conducted in 40 localities in 1938 and eight in 1939, while numerous counts of aphids in potato fields were made in the same two years and in 1940, all parts of the country being uniformly represented.

The results were examined statistically, and the influence of topographical and meteorological factors, such as wind, relative humidity, and temperature, were studied with the aid of a slide-rule specially designed by the author which facilitated calculations involving four independent variables of proportionals for infection conditions. To test the spread of infection isolated plots were used having seven rows with 25 plants per row, the rows, from east to west, arranged thus: virus Y, healthy two rows, virus X, healthy two rows, virus Y.

The dissemination of infection within the individual plots was shown to be practically identical on the eastern and western sides. The incidence of the disease averaged about 1½ times higher in the rows adjoining those infected by virus Y than in the ones separated by a row from the source of contamination. The effect of shelter from the wind varied with the other general conditions for infection. Thus, in localities with a high infection percentage, the number of diseased plants and extent of aphid infestation were not much greater in sheltered plots than in the open field. Where the infection percentage was moderate there was an average of 67 per cent. more virus Y and a correspondingly larger number of aphids in sheltered spots than in the open. In places with a very low infection percentage the number of aphids was still much larger in sheltered than in exposed situations, but nevertheless the average incidence of virus Y was relatively high in the latter, presumably owing to transmission through the agency of wind mutilation. The

latter mode of dissemination is considered unlikely to assume any practical importance in seed-potato production.

Virus Y was strikingly more prevalent in the immediate vicinity of towns and of the coast, at any rate in low-lying areas, than in comparable regions at a distance from these centres. For example, in 1938 the maximum incidence of infection in the whole country (78·6 per cent.) was recorded at Egholm in the Great Belt, while other relatively high percentages were reported from Højer Marsh (36·5), Thorstedlung on Roskilde Fjord (44·7), and near the town of Borris (west Jutland), situated in the midst of water-meadows (34·6). On 1st August, 1939, the number of aphids per 100 leaves near the town of Varde (west Jutland) was 248 compared with 126 3 km. to the north; at Skanderborg (east Jutland) on 27th July 191 per 100 leaves and 3 km. to the east only 14; while in bogland in South Zealand and west Jutland maxima of 680 and 580 aphids, respectively, per 100 leaves were reached on 21st July.

An investigation in 1938 on the connexion between infection percentages and meteorological factors resulted in the establishment of a high degree of positive correlation between the mean July temperature and the incidence of virus Y but the line of regression was not straight. However, straight-lined regression did occur between the logarithms of the infection percentages and the mean July temperature. Calculations were further made on the correlation between the logarithms of the infection percentages and most of the available meteorological data on the basis of experimental results in localities remote from towns or marshy areas. The coefficient was highest for the mean July temperature, and since the aphid population develops largely during this month the connexion may be regarded as biologically significant. The experimental localities were then relegated to three groups, viz., (1) less than 1 km. from towns or marshes and the like, which appear to favour the hibernation of *M. persicae*; (2) 1 to 3 km. from the foregoing and less than 1 km. from villages and moorland areas; and (3) over 3 km. from towns and marshes, &c., and more than 1 km. from villages and moorlands. In group (1) the average deviation in the logarithms of the infection percentages between the observed data and those expected on the basis of the mean July temperature, number of rainy days in June, and relative humidity in June was +0·4587, the corresponding figures for (2) and (3) being +0·0917, and −0·0893, respectively. These figures afford unmistakable evidence that virus Y infection diminishes rapidly with increasing distance from towns and low-lying areas under comparable meteorological conditions.

From aphid counts in 1939 it was learnt that the number of insects increases on a logarithmic scale during the early part of the season [cf. ibid., xx, p. 420], a clear positive correlation being found between temperature and the number of generations. The average daily logarithmic increase was 0·0912 at 16·8° C. Presuming an even distribution of aphids over the fields, the incidence of virus Y infection should, according to logical expectation, be directly proportional, in normal years, to the total number of aphid-days within the season.

The meteorological conditions influencing the flight of alate aphids were also studied. It was difficult to differentiate the effect of the June temperature on flight from that of the same factor in July on multiplication, but this is a matter of no great moment, since the latter is the more important of the two conditions, and in any case the resultant trends are in the same direction. There was no true correlation between wind velocity in June and the incidence of virus Y except when sheltered plots were compared with those in the open field, probably because the meteorological data relating to this factor are not applicable to the conditions prevailing at soil-level, whence the alate aphids set off on their flight. The incidence of infection in the test plots was negatively correlated with the relative atmospheric humidity in June and the number of days of rainfall, but not with the amount of

precipitation measured in mm. The explanation of this apparent discrepancy is presumably that the relative humidity of the air circulating round the plants depends on both the atmospheric humidity, measured at a height of 2 m. above ground-level, and the number of rainy days. The mathematical expression of the relationships of these factors is discussed.

It is concluded from the foregoing data that the correlation between the number of days of rainfall and logarithms of the infection percentages is due to true biological causes.

In the course of these investigations several cases of partial infection of Bintje plants with virus Y were observed. It frequently happens that the progeny of a plant attacked during the current season consists of a mixture of sound and diseased individuals, while the virus may also be localized in single tubers. In plants arising from the latter, one or more shoots may show symptoms of rugose mosaic, while the rest look quite healthy during the first few weeks of the season. Obviously, therefore, the virus moves very slowly in maturing plants, while in dormant tubers it is probably quiescent. Serological tests, moreover, indicate that the virus concentration in thoroughly infected dormant tubers is very low.

Stevenson (F. J.), Schultz (E. S.), Akeley (R. V.), & Cash (Lillian C.). **Breeding for resistance to late blight in the Potato.**—*Amer. Potato J.*, xxii, 7, pp. 203–223, 1945.

Several progress reports on the programme of potato-breeding for resistance to late blight (*Phytophthora infestans*) initiated 12 years ago by the United States Department of Agriculture co-operating with the Maine Agricultural Experiment Station have already been published [*R.A.M.*, xvii, p. 267]. The present paper tabulates the results up to date and includes a discussion of some of the more recent family lines and potential commercial selections.

Varieties showing reactions to the pathogen ranging from complete susceptibility to immunity have been used as parents in the project. A few seedlings with an intermediate type of resistance arose from crosses between two susceptible varieties, such as Chippewa and Katahdin, but a much larger proportion was produced when intermediates, e.g., President and its relatives, served as progenitors of selfed lines and crosses. The intermediates of the latter series were all late and did not excel Sebago in other characters. Selections from the original introductions of the German *W* races proved highly resistant to blight and early maturing, but their yields were low and their market quality inferior. However, the offspring of crosses between some of these selections and American varieties and seedlings, for instance, Earlaine, Katahdin, and 336–18, retained the blight resistance of their foreign parents with the addition of commercially desirable features. A number of these crosses were in turn selfed, sib-mated, and out-crossed to different commercial varieties and promising seedlings with highly encouraging results, and it is hoped shortly to name and distribute one or more of the progenies to growers. No significant correlation was established between time of maturity and reaction to *P. infestans* in several selections segregating for both characters.

Eddins (A. H.). **Transmission and spread of late blight in seed Potatoes.**—*Amer. Potato J.*, xxii, 11, pp. 333–339, 2 figs., 1945.

The results of experiments carried out at Hastings, Florida, showed that late blight (*Phytophthora infestans*) spreads from diseased to healthy Maine-grown tubers in seed bags under certain conditions, notably when the potatoes are stored out-of-doors, remaining wet for protracted periods during rainy weather, or kept in continuous shade where drying after rain takes place slowly. The average percentage of loss from the disease over the period from 1936 to 1945 was 4·8.

The development of the pathogen was favoured by 25 rainy days in December, 1936, and January, 1937, when 15 per cent. of the seed exposed to the weather contracted infection; after it was planted, the fungus made rapid growth in the seed pieces and formed spores on the sprouts and young stems. Much of the diseased seed dies or produces poor plants. Numerous primary infections were observed in the field and in the greenhouse, but the data were insufficient to define the conditions under which the disease originates from infected seed planted in the field.

Infected seed is concluded to be the primary source of late blight in Florida. The transmission and spread of the fungus should be largely preventable by digging the tubers after the tops have matured and died or been destroyed by frost or herbicides [*R.A.M.*, xxv, p. 276] and discarding all contaminated material before dispatch.

LARGE (E. C.). **Field trials of copper fungicides for the control of Potato blight. I. Foliage protection and yield.**—*Ann. appl. Biol.*, xxxii, 4, pp. 319–329, 7 graphs, 1 diag., 1945.

The author presents the results of eight replicated trials at several centres in Cornwall during 1941 to 1944 of Bordeaux mixture and some recently introduced copper fungicides for the control of potato blight (*Phytophthora infestans*). In the course of the experiments the author sought to determine (1) the extent of disease incidence on the foliage at successive dates with a view to ascertaining the conditions of the tests and appraising the degree of protection afforded by the fungicides to the foliage; and (2) the degree of spray retention. Mean assessments of disease intensity for whole plots were represented by the categories 0·0, 0·1, 1, 25, 50, 75, and 100 per cent. foliage destroyed, in conformity with the British Mycological Society's recommendations in 1942 [*R.A.M.*, xxii, p. 365].

The progress of infection on the sprayed foliage followed much the same course as on the untreated only, however, after a time lag conditioned by the timing of spraying in relation to that of *Phytophthora* attack. The results showed that in 1941, when in August heavy rains occurred between the second spraying and the appearance of the first blight symptoms, both sprayings were given a month too early; in 1942 sprayings coincided remarkably with the attack of the pathogen and maximum prolongation of growth was secured; the second spraying in 1943 was given too late, the disease being already present and over 1 per cent. of the foliage infected; while in 1944, three cold, dry days are considered to have arrested the progress of the pathogen and thus rendered the second spraying premature.

In order to measure the prolongation of growth resulting from spraying, the date of 'half-decay' was plotted on foliage decay curves and the time lag then determined between the dates of decay in sprayed and unsprayed foliage, which is thought to offer the most reliable single numerical criterion of the direct effect of spraying.

In plotting the foliage-decay curves the probit transformation method described by C. I. Bliss (*Ann. appl. Biol.*, xxii, p. 307, 1935) was adopted, and it was found in the present experiments that there was often an approximately linear relationship between probit-leaf destruction and time, although at first there was no ground for assuming that the normal course of foliar destruction would tend to follow the probability-integral law on which Bliss's method is based. Throughout the author's trials this relationship held true in respect of unsprayed foliage, within limits of accuracy of the original determinations of foliage damage; and where linear divergences occurred on the curves for sprayed foliage, this was associated with varied meteorological conditions during the period of *Phytophthora* infection. The use of the probit transformations for potato-blight progress curves is justified

by comparing the curves obtained by this method and those obtained by using the growth law based on suggestions by Jensen and Rostrup (1892).

The mean prolongation of growth obtained from all the trials during the three-year period was 16½ days.

Potato yields are conditioned by so many factors other than those of foliar protection, that their data have little practical value in comparative tests of spraying material [*R.A.M.*, xvii, p. 260], the results of past work on the subject finding confirmation in the present studies. Although the data here collected present disparities between the yields from sprayed and unsprayed crops which are highly important, the differences in yield between respective treatments were often so insignificant as to have little or no practical value.

Obvious differences, however, in the direct prophylactic effects of the various sprays on potato foliage were fairly constantly associated with the spray retention factor. The enduring protective value of Bordeaux mixture (4–5–40) was once more reaffirmed, although cuprous oxide plus bentonite sticker proved almost equivalent at the same copper dosage. Bordeaux mixtures at half their copper dosage were just as effective as cuprous oxide and copper oxychloride, compounded with water-soluble dispersing agents and without stickers. There was little to choose between metallic copper, compounded with bentonite in relatively coarsely divided form, and finely sifted cuprous oxide without sticker at the same copper dosage. The fungicidal action of cuprous oxide has been attributed to the copper made available as the cupric ion and not to that deposited as more or less inactive copper metal, but it is concluded that any metallic copper so formed must undergo rapid oxidation on exposure and the whole of the copper thus becomes effective fungicidally.

Small (T.). **The effect of disinfecting and bruising seed Potatoes on the incidence of dry rot (Fusarium caeruleum (Lib.) Sacc.).**—*Ann. appl. Biol.*, xxxii, 4, pp. 310–318, 1945.

Continuing his investigations [*R.A.M.*, xxiv, p. 201] into potato tuber dry rot, caused by the wound parasite *Fusarium caeruleum*, the author shows in experiments made with the susceptible variety Ninetyfold, bruised and disinfected [ibid., xxiii, p. 38] with a proprietary organo-mercury preparation, aretan, that tubers bruised at digging time and disinfected at once were little damaged by dry rot in the majority of tests made. Disinfection at a later date retarded the disease somewhat in certain cases, but not in others. Seed-tubers, well bruised one or two weeks after disinfection were with one exception almost entirely healthy. On the other hand, in the course of four out of six tests serious dry rot developed in tubers severely bruised about three months after disinfection. The result of inoculating sound tubers with soil samples showed that the pathogen is widely present in Cheshire potato fields. Seed-tubers, whether disinfected or not at harvest time and not experimentally bruised remained healthy until planted in the following year, provided they were left undisturbed in their boxes. Others, experimentally bruised at harvesting or one or two weeks later, almost all suffered serious injury from *F. caeruleum*. By October the pathogen was no longer active, but when sound, untreated tubers were bruised in October, they at once developed dry rot, although disinfection before bruising controlled the loss adequately in five out of six tests.

It is regarded as highly likely that in lofts, sacks, hampers, and the like, *F. caeruleum* remains viable from one season to another and contaminated tubers may suffer further from disturbance by storage-workers and also derive fresh infection where, for example, the pathogen is present in dust diffused when lofts are swept. Contaminated seed arriving at warehouses and being discharged into boxes can spread the disease. Of 70 sound, treated tubers, cut in half with a sterile knife and

exposed to floor sweepings, 70 halves being placed in a moist chamber and 70 left in store, 60 of the former and 36 of the latter contracted dry rot.

The general conclusion reached confirmed Foister and Wilson's findings [loc. cit.] that dipping of seed potatoes is undoubtedly an important means of protecting them against damage in the course of handling or storage. This is particularly true in the case of imported seed-tubers, although those locally produced sometimes develop dry rot in the circumstances mentioned. The present studies suggested that the best time for dipping is just before the tubers are likely to require handling, or if this is impracticable, immediately after handling. Aretan, or other organo-mercury compounds, and formaldehyde [ibid., xix, p. 614] have proved satisfactory, although their period of efficacy may be limited, as suggested by the appearance of dry rot in disinfected seed-tubers subsequently exposed to further bruising. In view, also, of their poisonous nature, a harmless fungicide is much to be desired. As regards clamped tubers, the writer's experience in 1943–4 indicates that for seed-potatoes undamaged when clamped down adequate protection against subsequent dry rot is offered by dipping immediately the clamp is opened and, if this continues to be confirmed, the question of labour difficulties presented by disinfection at lifting time should be removed. It may be advisable to make such delayed treatments longer and more thorough than in the case of tubers freshly dug and still moist.

Blodgett (E. C.) & Ray (W. W.). **Leak, caused by Pythium debaryanum Hesse, produces typical 'shell rot' of Potato in Idaho.**—*Amer. Potato J.*, xxii, 8, pp. 250–253, 1 fig., 1945.

Pythium debaryanum was the agent of a widespread tuber rot in the Idaho potato crops of 1943 and 1944, particularly heavy damage having been sustained in the latter year. The outstanding symptom in stored potatoes is the disorganization of the interior of the tuber into a soft, brown decay, leaving in most cases a shell of sound tissue, up to $\frac{1}{4}$ in. in thickness, almost completely surrounding the affected area, hence the popular designation of 'shell rot'. During the month or so immediately following digging, however, the predominant feature of infection was a leak, ultimately involving the whole tuber in a very watery breakdown. High temperatures during and just after harvest appear to be a decisive factor in the development of infection in any particular lot. Samples of diseased tubers from different localities consistently yielded *P. debaryanum* [*R.A.M.*, xxiv, p. 202].

Two facts are noteworthy in this account, namely, the occurrence of leak in storage (it has long been known as a disease of the early crop in Idaho), and its hitherto unrecognized connexion with the 'shell-rot' complex.

Bondartsev (A. S.). К пораженію картофеля опенком **Armillaria mellea (Vahl) Quél.** [The honey agaric fungus, *Armillaria mellea* (Vahl) Quél., pathogenic on Potato.]—*Sovetsk. Bot.*, xiii, 5, p. 28, 1 fig., 1945.

The author describes the infection of potato tubers by *Armillaria mellea* [*R.A.M.*, xvi, p. 832] observed in 1942 on allotments in the grounds of the Komarov Botanical Institute in Leningrad, and believed to be the first record of an attack on potato by this pathogen in Russia. It is recommended that potatoes should not be sown in newly-dug park or forest land as a means of avoiding a further appearance of this disease.

Symposium on bacterial ring rot of Potatoes. Present status of bacterial ring rot in Canada.—*Proc. Canad. phytopath. Soc., 1944*, pp. 14–17, 1944.

The only practical means of controlling bacterial ring rot of potatoes (*Corynebacterium sepedonicum*) [*R.A.M.*, xxiii, p. 275; xxiv, pp. 31, 246] consists in eliminating the disease on farms where it already exists and preventing its intro-

duction into districts where it has not yet appeared. All potatoes on an affected farm should be disposed of, and in such a manner that they do not find their way to another farm, to be planted there. All storage places and tools should be disinfected, and clean seed planted the next season. To prevent the introduction of the disease, only fully certified seed should be purchased, and all used bags disinfected. The Dominion Department of Agriculture is controlling ring rot in certified seed [cf. ibid., xxii, p. 9], but it rests with the Provincial Departments to control it in table stock.

The main difficulty in control is detection in trace infections. The simplest way is to follow the digger at harvest and watch for affected potatoes. The next-best time is when the potatoes are being graded after four weeks' storage or more. Detection is even easier in spring, when more tubers have broken down. Culls should be examined carefully.

The next difficulty is to prevent infection on a farm when the disease is present in the vicinity. Infection may occur through an exchange of machinery, careless cutting by inspectors or purchasers of diseased tubers on one farm and healthy ones on another with the same unwashed knife, the exchange of empty used bags, and the indiscriminate planting of odd lots of potatoes. Constant vigilance is essential.

Nielson (L. W.) & Todd (F. A.). **Preliminary evaluation of some soil disinfectants for controlling southern bacterial wilt of Potatoes.**—*Amer. Potato J.*, xxii, 7, pp. 197–202, 1945.

In preliminary experiments on the variety Irish Cobbler in eastern North Carolina in 1943 and 1944, the application to the soil before ploughing of sulphur-lime, as used by Eddins in Florida [*R.A.M.*, xvi, p. 271], lime-urea (uramon), recommended by Smith and Clayton [ibid., xxii, p. 278], and ammonium thiocyanate (1,000 lb. per acre), effective against *Synchytrium endobioticum* in R. H. Bell's trials in Pennsylvania [ibid., xv, p. 112], gave promising results in the control of southern bacterial wilt (*Pseudomonas* [*Xanthomonas*] *solanacearum*). In the former year the three treatments (in the order named) reduced the incidence of infection from 30·6 to 11·2, 4·8, and 0, and in the latter from 53 to 16, 0·4, and 2·2 per cent., respectively.

Wager (H. G.). **The effect of P_H on stem-end blackening of Potato.**—*Bio-chem. J.*, xxxix, 5, pp. 482–484, 2 graphs, 1945.

The greyness of cooked potatoes of certain varieties (stem-end blackening) [*R.A.M.*, xxv, pp. 33, 358] was estimated at a range of P_H values and found to increase rapidly towards the upper limits. The absorption of light by a water extract of stem-end blackening pigment at P_H 1 to 9 was also measured. On the basis of these experiments the defect is attributed to the action of a single pigment, the colour of which is reversibly affected by P_H, variations between different stocks in the degree of blackening being due to disparities in the amounts of the pigment they contain.

Saha (J. C.). **Hot water treatment of Paddy seeds against seed borne infection of Helminthosporium.**—*Sci. & Cult.*, xi, 9, pp. 502–503, 1946.

At the Presidency College, Calcutta, the writer obtained complete elimination of *Helminthosporium* [*oryzae*: *Ophiobolus miyabeanus*] in the Boldar, Marichbati, Latisail, Larkoch, and Jhanjee rice varieties by four hours' immersion in water heated to 54°±0·5° C. The treatment also increased the germinability of the seed if sown immediately, and even after storage for a week or longer the loss in germinative capacity did not exceed 5 per cent. The cost of this method of control would

be negligible in comparison with the damage caused annually by the disease, particularly in Bengal, and the necessary conversion of the existing machinery for bulk treatments, say of 40 to 80 lb. lots, should be quite feasible.

SANFORD (G. B.). **Soil-borne diseases in relation to the microflora associated with various crops and soil amendments.**—*Soil Sci.*, lxi, 1, pp. 9–21, 1 fig., 1946.

In an attempt to elucidate the factors affecting soil-disease incidence the author selects five common soil-borne diseases, four of which, common scab (*Actinomyces scabies*) and stem canker (*Rhizoctonia* [*Corticium*] *solani*) of potato and the wheat rots (*Helminthosporium sativum* and *Fusarium culmorum*), are also vigorous soil saprophytes, and the fifth, *Ophiobolus graminis*, which is not, and reviews the relevant work on them.

Previous research on the effect of soil moisture content and organic manuring on scab incidence pointed to the possibility that they acted advantageously when they favoured an antagonistic microflora. Two experiments carried out by the author show that the addition of chopped green rye or clover to soil artificially infected with scab reduced the incidence of the pathogen in tubers planted in it by 17 and 30 per cent. using rye and by 8 and 49 per cent. using clover. As other external conditions were kept constant and were favourable to disease incidence it was assumed that the differences were due to the antibiotic microflora encouraged by the treatment. Petri dish soil-on-agar cultures demonstrated the antibiotic action of certain soil-inhabiting bacteria to the scab, stem-canker, and root-rot (*H. sativum*) organisms.

Evidence from various sources, particularly in relation to stem canker, suggests that the detection of antibiotic activity in culture does not necessarily imply that the same may occur in the field. This and the results of the author's own experiments on the incidence of *C. solani* in inoculated soil with different manurial amendments show that microfloral activity is very variable, and that it may be the quality rather than quantity that matters.

In reviewing the conditions favouring the incidence and increase of the three root-rot organisms and their ability to reinfect after a period without the host, the behaviour of *H. sativum* and *F. culmorum* on the one hand is contrasted with that of *O. graminis* on the other. The evidence is discussed for considering whether the different behaviour of the last-named is due to its more highly specialized parasitic nature or to its greater sensitivity to antagonistic microflora either in the decomposing plant remains or in the rhizospheres of the succeeding crops.

The author then goes on to survey the literature on the rhizosphere, from which it is apparent that the rhizosphere population is different from that of the soil outside in quality, quantity, and nutritional requirements, and its nature seems to depend on the type of plant rather than on the type of soil. He suggests that it might be possible to modify the microbial balance without resorting to antibiosis, citing as an example the differential effect of soy-bean and red clover as cover crops on the incidence of strawberry root rot [*R.A.M.*, xx, p. 540]. Here the control by soy-bean is attributed to the effect of the decomposition products on the microflora. Another example is the effect of resistant and susceptible varieties of flax on the growth of various root fungi in their rhizospheres. Susceptible varieties of flax and tobacco have also been shown to support different rhizosphere populations from the corresponding resistant varieties.

The writer sees the whole as a complex problem in which the different nutritions of the host, pathogen, and the microflora are regarded as the basic factors in disease incidence. Root excretions of both host and non-host plants might influence adversely or favourably the host-pathogen status either by acting on the pathogen directly, or indirectly by affecting the micro-organisms which may influence its life. The study of soil amendments in these respects is thus very important.

CHUPP (C.). **Soil temperature, moisture, aeration, and pH as factors in disease incidence.**—*Soil Sci.*, lxi, 1, pp. 31–36, 1946.

After reviewing the interrelationships between air temperature and soil temperature, the author cites the reactions of many well-known fungi to these factors. For instance, species of *Cercospora* multiply readily in hot, and those of *Septoria* in temperate climates; the tomato wilt (*Pseudomonas* [*Xanthomonas*] *solanacearum*) appears rarely under the climatic conditions of New York State, although large consignments of seedlings are imported annually from Georgia, where the warm climate renders the disease a serious concern to the grower. *Phytophthora infestans* is highly sensitive to temperature changes, so that the raising of the soil temperature by a few degrees may suffice to ward off a serious attack of potato blight.

Other examples are given of the influence of soil moisture and soil reaction. The fact that parasites have an optimum range of pathogenicity for these conditions is well known. Where this range is narrow the virulence of attack may be controlled by extending these conditions beyond the range of tolerance of the fungus. On the other hand, some fungi are more widely tolerant and therefore more difficult to control in this way. Even so these physicochemical factors are so closely interdependent that conflicting results are often obtained and accepted control measures sometimes fail.

JONES (K. L.). **Further notes on variation in certain saprophytic Actinomycetes.**—*J. Bact.*, li, 2, pp. 211–216, 5 figs., 1946.

Variation in certain saprophytic soil Actinomycetes on a synthetic medium has already been reported (*Proc. Soil Sci. Soc. Amer.*, v, pp. 255–258, 1940). Since then observations have accumulated at the University of Michigan on the effects of various factors on this process. When freshly isolated, the entire range of types is secured, irrespective of the colony selected for inoculum, but the frequency of types may be affected by the amount of inoculum and by continued selection. Prolonged subculturing on laboratory media leads to the modification or loss of the following characteristics: (1) thickness, surface, margin, and texture of the mycelium as viewed macroscopically; (2) growth rate; (3) presence or absence of aerial hyphae and conidia; (4) distribution of these organs; (5) deliquescence on the surface of the growth; (6) presence or absence of pigments; (7) type of colour; and (8) rate of calcium malate and starch digestion. At least partial restoration of the original distinguishing features of the several strains may be effected by culturing on sterilized soil.

CASTELLANI (E.). **Su due malattie del Cartamo osservate nell' altopiano etiopico.** [On two diseases of *Carthamus* observed on the Ethiopian plateau.]—Reprinted from *Agricoltura colon.*, xxxiv, 8, 10 pp., 8 figs., 1940. [Received February, 1946.]

Carthamus tinctorius growing on the Ethiopian plateau was observed to be affected by rust (*Puccinia carthami*) [*R.A.M.*, xxiv, p. 4]. The uredosori, mostly found on the lower surface of the leaf blade, measured 0·33 to 0·46 mm. in diameter, the uredospores 21 to 26 by 19 to 22·5 μ, the teleutosori (also on the lower surface) 0·6 to 0·8 mm. in diameter, and the teleutospores (mostly uniseptate) 25 to 28 by 30 to 35 μ. No pycnidia or aecidia were observed.

The same host was also attacked by leaf spot (*Cercosporella carthami*) [ibid., vi, p. 355]. Infection began when the plants were one month old, and became very severe during flowering, attacking the leaves (especially those nearest the ground) and occasionally the bracts and stem. Small spots, 2 to 30 in number, pale at the centre and surrounded by a dark green halo, with a well-defined edge, appeared scattered over the leaf blade. At first visible only by transparency the spots later became yellow, then dark brown. The interveinal ones were round, while those

near the edges or the principal veins were semicircular, polygonal, or irregular. Each spot showed a small, pale central area surrounded by a halo up to 1 mm. wide, becoming light yellow, later dark. On heavily infected leaves this halo was inconspicuous, its colour merging into that of the leaf, which also became light yellow, then dark, the leaf surface being covered with numerous necrotic spots. In very severe attacks, the leaf margins became contorted and the spots cracked. Many leaves dropped, the photosynthetic activity of those remaining became greatly reduced, and seed production was much diminished. Infection was favoured by wet seasonal conditions.

The fungus showed mostly simple, occasionally branched, erect or slightly curved conidiophores measuring 75 to 150 by 3 to 4 μ, and bearing acrogenous or acropleurogenous, hyaline, subclavate, 0- to 5- (2- to 3)-septate conidia measuring 30 to 75 by 3·6 to 6·5 μ, readily germinating in damp conditions, and sometimes briefly catenulate. The conidiophores emerged in tufts of 12 to 20 through the stomata, and in very wet conditions, directly through the leaf epidermis, generally from substomatic stromata though sometimes from light, barrel-shaped cells of the stromata. No control measures are indicated against the rust; against *C. carthami* spraying with Bordeaux mixture containing 1 per cent. of copper sulphate is advised.

CASTELLANI (E.). **Il vaiolo del 'Cossò'.** ['Cosso' leaf spot.]—Reprinted from *Agricoltura colon.*, xxxvii, 5, 6 pp., 2 figs., 1943. [Received February, 1946.]

During 1937, a group of *Hagenia* [*Brayera*] *abyssinica* (syn. *B. anthelmintica*) plants [cultivated in Abyssinia for use as an anthelmintic], growing in a rather damp depression near Amba Gheorghis, Amara, showed numerous small, round or polygonal spots on the leaves and stipules. The centres were light yellowish, but later became necrotic, and were surrounded by an irregular, anthocyanic halo up to a few mm. wide. The spots frequently became confluent, sometimes involving half the leaf blade. On the lower and, very occasionally, the upper leaf surface, erumpent acervuli developed on the spots and contained numerous hyaline, cylindrical, straight or more often curved, sometimes geniculated conidia 32 to 45 by 2·5 to 4 (3) μ, and 0- to 4-septate, which emerged as a whitish, subgelatinous mass.

The author regards the fungus as a new species of *Phleospora*, which he names *P. hageniae* n.sp. A Latin diagnosis is expected to appear later.

LINDEGREN (C. C.). **Yeast genetics: life cycles, cytology, hybridization, vitamin synthesis, and adaptive enzymes.**—*Bact. Rev.*, ix, 3–4, pp. 111–170, 7 figs., 8 diags., 1945.

In addition to the aspects of yeast genetics mentioned in the title, this paper deals with mating types, cultural variability and stability, spores and sporulation, speciation in yeasts, budding, structure of the colony, and dormancy. A bibliography of 83 titles is appended.

MCCUBBIN (W. A.). **Preventing plant disease introduction.**—*Bot. Rev.*, xii, 2, pp. 101–139, 1946.

This is a very comprehensive and useful review of 89 papers, many of which have already been noticed from the original sources, dealing with legislative measures for the exclusion of plant diseases from the United States [*R.A.M.*, xxiv, p. 461]. The aspects of the problem discussed include the reality and costliness of foreign disease introductions, effectiveness of quarantine measures, special relations of contiguous land areas, natural channels for the introduction of plant pathogens, introduction through human activities, relation of biological races to disease introduction, natural barriers to disease introduction, factors affecting national efforts to prevent disease introduction, programme and procedures of disease exclusion, and the role of the foreign certificate.